VOL. 7, NO. 16
August 31, 1982

Energy Research Abstracts

ABSTRACTS 40076-41976

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Telephone (615) 576-1303; (FTS) 626-1303.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Goverament Printing Office, Washington, D. C. 20402; domestic subscribers $4.50, foreign $5.65 per copy; annual cumulative index, domestic $7.00, foreign $8.75 per copy. The annual subscription price is $48.00 for domestic subscribers and $60.00 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $150.00 for domestic subscribers and $187.50 for foreign subscribers. A single issue costs $6.50 (domestic) or $8.15 (foreign).

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A semimonthly current awareness bulletin covering all aspects of the nuclear fuel cycle, both front end and back end. Available as PB82-913400.

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Radioactive Waste Management (RWM)

A semimonthly current awareness bulletin covering the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers. Available as PB82-902900.

INTERNATIONAL ENERGY PUBLICATIONS

Atomindex (Published in cooperation with the Technical Information Center by the International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria)

A semimonthly abstract journal devoted to information on nuclear science and technology. Through an exchange agreement, IAEA/INIS provides all non-U. S. nuclear information of *Atomindex* to TIC for inclusion in the Energy Data Base; in turn, TIC provides all U. S. nuclear information to IAEA/INIS for inclusion in *Atomindex*. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Coal Abstracts (Published in cooperation with the Technical Information Center by the International Energy Agency, IEA Coal Research, London, England)

A monthly abstract journal devoted to information on coal. Through an exchange agreement, IEA Coal Research provides non-U. S. coal information of *Coal Abstracts* to TIC for inclusion in the Energy Data Base; in turn, TIC provides all U. S. coal information to IEA Coal Research for inclusion in *Coal Abstracts*. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to catalog official DOE issue-and-policy documents, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers, and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

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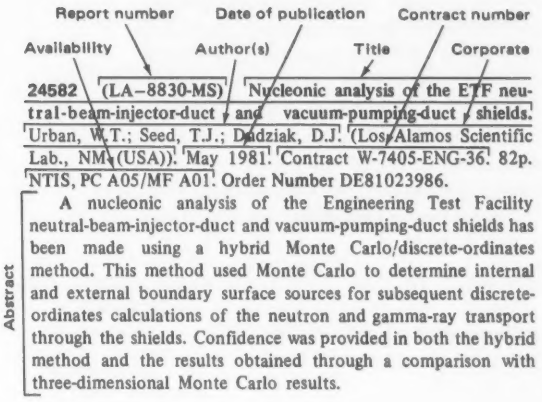
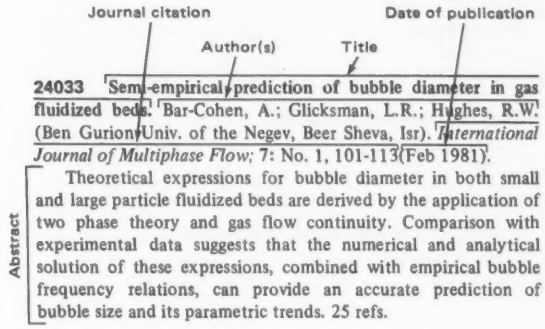

Report number
Date of publication
Contract number
Availability
Author(s)
Title
Corporate
24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.
A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.
Abstract


Journal citation
Date of publication
Author(s)
Title
24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr). International Journal of Multiphase Flow; 7: No. 1, 101-113 (Feb 1981).
Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.
Abstract

• INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Bar-Cohen, A., Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033
Dudziak, D.J., *See* Urban, W.T., 6:24582
Glicksman, L.R., *See* Bar-Cohen, A., 7:24033
Hughes, R.W., *See* Bar-Cohen, A., 7:24033
Seed, T.J., *See* Urban, W.T., 6:24582
Urban, W.T., Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles or informative phrases, or both, specific to these entries are arranged alphabetically under the entries.

TOKAMAK ETF
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Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)
Neutron Transport
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)

• Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
	6:24582	LA–8830-MS

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number-Report Number Correlation is included for convenience.

LA–		
8830-MS	6:24582	NTIS, PC A05/MF A01. Order Number DE81023986, Distribution Category STD-20d

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts.* The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
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ENERGY RESEARCH ABSTRACTS

00 EIA PROGRAMS AND PRODUCTS

40076 **(NASA-CR—165512) Low NO/sub x/ heavy fuel combustor concept program. Final report, 23 Oct 1979 - Jul 1981.** Russell, P.; Beal, G.; Hinton, B. (United Technologies Corp., South Windsor, CT (USA)). Oct 1981. 99p. NTIS, PC A05/MF A01.

A gas turbine technology program to improve and optimize the staged rich lean low NOx combustor concept is described. Subscale combustor tests to develop the design information for optimization of the fuel preparation, rich burn, quick air quench, and lean burn steps of the combustion process were run. The program provides information for the design of high pressure full scale gas turbine combustors capable of providing environmentally clean combustion of minimally of minimally porcessed and synthetic fuels. It is concluded that liquid fuel atomization and mixing, rich zone stoichiometry, rich zone liner cooling, rich zone residence time, and quench zone stoichiometry are important considerations in the design and scale up of the rich lean combustor.

01 COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 40726, 40922

0104 Processing

REFER ALSO TO CITATION(S) 40138, 40155, 40155, 40165, 40171, 40199, 40200, 40214, 40215, 40348, 40348, 40368, 40688, 41092, 41092

40077 (CONF-811061—, pp 27-28) **Materials performance in EDS coal liquefaction pilot plant: a status report.** Sorell, G. 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Today's presentation is a materials oriented update of EDS pilot plant (ECLP) experience, covering its first year of operation on Illinois No. 6 coal. In general, we have been well pleased with the performance of construction materials in critical services and equipment. Except for a few instances of localized erosion and one corrosion failure, experience has been favorable. The overall good materials performance contributed significantly to successful ECLP operation. Instances of localized slurry erosion were experienced in feed lines at piping tees, in a mixing chamber combining two slurry streams, and in a liquefaction reactor. The reactor problem occurrred as a result of feed slurry bypassing the flow distributor adjacent to the vessel wall. In all instances, erosion was caused by high flow velocities and/or turbulence, and was confined to small areas. The performance of slurry letdown valves and slurry pumps was quite satisfactory with respect to erosion. Localized corrosion-erosion occurred in the product fractionator and stress corrosion cracking developed in a bubble cap stainless steel distributor.

40078 (CONF-811061—, pp I.1-I.7) **Materials research for the clean utilization of coal. Task 2. Materials performance and properties data.** Ondik, H.M.; Christ, B.W. (National Bureau of Standards, Washington, DC). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Sources of the information compiled by the Materials and Components Plant Performance Data Center include operators of all gasification and liquefaction processes, from bench-scale units through operating pilot plants participating in the DOE voluntary failure reporting program. Informational detail varies from one-page failure occurrence reports to final reports of laboratory analyses of failed parts. The Materials Properties Data Center compiles data extracted primarily from the research reports of DOE contractors who are studying materials of construction which are candidates for use in coal conversion plants and MHD power generation plants. There are currently some thirty projects generating materials properties and performance data for coal conversion use and about a dozen projects generating materials data for MHD power generation. A computerized data base of approximately 500 reported failures has been established and is continually being updated, refined and increased as additional failure reports are received.

40079 (CONF-811061—, pp I.8-I.14) **Nondestructive testing: erosive wear detection/monitoring.** Youngdahl, C.A.; Ellingson, W.A.; Reimann, K.J.; Caines, M.J. (Argonne National Lab., IL). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The objectives of this subtask are to (1) develop nondestructive methods to measure (monitor) erosive wear of high-temperature process piping systems as used in coal conversion systems and (2) evaluate the reliability of nondestructive evaluation methods for measuring erosive wear. This task focuses on metal structures. The objectives are being approached through a combined laboratory and field testing program. Laboratory work has been involved with establishing alternate coupling methods between waveguides and pressure boundaries to allow more flexibility in the measurement system. This work has included high-pressure coupling and advanced ultrasonic transducer development [electromagnetic acoustic transducers, EMATs]. Acoustic velocity measurements at elevated temperatures needed for reliable wall thickness measurement is also part of the scope of this program. Field site testing has included complete field installations at gasification and liquefaction pilot plants to prove applicability of the nondestructive testing methods under field conditions and to allow adjustments to be made in the operation of the system for higher reliability.

40080 (CONF-811061—, pp I.15-I.23) **Failure analysis for gasification plants.** Diercks, D.R. (Argonne National Lab., IL). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The objectives of this program are: (1) to provide failure analysis services and evaluate the performance of coal conversion plant components that have failed or have otherwise been removed from service, (2) to make recommendations concerning materials selection, component design, or process conditions so that similar failures can be avoided, and (3) to disseminate this information for subsequent use in the design and operation of related pilot and demonstration plants. This program is designed to provide timely failure analysis services to coal conversion pilot and demonstration plants and component test facilities. In-depth analyses are cataloged, and the findings and recommendations resulting from these analyses are relayed to the pilot plants, the National Bureau of Standards Failure Information Center, and other laboratories. In addition to this failure analysis activity, pilot plant exposures of specific components may be performed from time to time under this program in order to assess their performance under actual plant operating conditions. Failure analyses on seven coal-gasification pilot plant components have been completed in the past year and the results are described.

40081 (CONF-811061—, pp I.24-I.28) **Acoustic valve leak detection.** Ellingson, W.A.; Sullivan, J.W. (Argonne National Lab., IL). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The most significant result this fiscal year has been the design and fabrication of a fluid-acoustic test facility designed to address leak detection in slurry-line block valves. The fluid-acoustic loop was designed to cycle a finite volume [3 x 10^{-2} m^3 (8 gal)] of fluid at a controlled rate. Under pressure from the hydraulic ram, the slurry flows through the test section (orifice plate), which simulates leaks in a block valve. The rate of flow through the test orifice depends on the orifice dimensions and the ram supply pressure; the ultimate limitation is the 68 x 10^{-3} m^3/s (29 gal/min) capacity of the hydraulic power supply. Flow rate is measured indirectly by differentiating the instantaneous voltage signal from a potentiometer attached to the ram. By suitable conditioning, the output signal from the differentiator is made directly proportional to volumetric leak rate. This flowmeter has been calibrated by measuring the actual flow rate in the test section, using an ASME orifice plate. The fluid medium for the initial calibration was water. In constructing the acoustic leak detection test facility, several fluid-dynamic phenomena relevant to ultrasonic cross-correlation flow measurements were considered. Specifically, flow regimes, turbulence structure, entrance effects, and secondary flows in the test facility were investigated for similarities to conditions at coal liquefaction plants.

40082 (CONF-811061—, pp II.1-II.12) **Program on materials for the gasification of coal.** Schaefer, A.O.; Barton, K.J.; Bhattacharyya, S.; Howes, M.A.H. (Metal Properties Council, Inc., New York, NY). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The Metal Properties Council program involves screening and behavior study of materials subject to gaseous corrosion or to corrosion by aqueous solutions of corrosive gases exposure of metals and refractories in gasification pilot plants, exposure to continued erosion and corrosion, and the measurement of the engineering properties of candidate materials under service conditions. Sixty-three alloys and coatings were chosen for corrosion testing; thirty-six survived short term screening tests and have been subjected to long time tests. Corrosion of most alloys in coal gasification atmospheres with up to 1.5 v/o H_2S occurs in two distinct stages: First is slow oxidation, which is followed by a breakaway very rapid sulfidation; at present, there is no way to predict the incubation period for breakaway corrosion. From the pilot plant exposures, if is concluded that high temperature alloys, such as Fe-Cr-Ni alloys with >23 w/o Cr and higher Cr cobalt-base alloys, are suitable for 1600°-1850°F. A greater number of alloys are suitable for temperatures below 1600°F. Some nickel alloys were unacceptable. Certain other results related to corrosion by aqueous solutions and combined erosion and corrosion are discussed briefly. (LTN)

40083 (CONF-811061—, pp II.13-II.18) **Evaluation of materials for letdown valves.** Wright, I.G.; Clauer, A.H.; Shetty, D.K.; Peterson, J.H.; Merz, W.E. (Battelle-Columbus Labs., OH). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The aim of this program was to establish erosion data on a number of candidate valve materials under a range of slurry erosion conditions which would be useful to valve and process engineers involved in materials selection and valve design. The program comprised three major tasks: Slurry Characterization to identify the erosive species and their behavior in a laboratory test rig, and to determine if major differences exist in the erosive nature of slurries from different coals and different liquefaction processes; Erosion Studies of currently-used and promising substitute valve trim materials under well-controlled test conditions to allow the development of data useful for understanding the processes of material loss during erosion, and for providing directions for modification of materials to gain improved erosion performance; and Service Trials of selected new materials to provide corroboration of laboratory erosion data, and to identify other obstacles to the application of advanced materials in actual valves. Materials studied were cemented tungsten carbides, ceramic silicon carbide and hot-pressed boron carbide; screening tests were performed on cemented titanium diborides. Results are discussed briefly.

40084 (CONF-811061—, pp II.26-II.41) **Corrosion and mechanical behavior of materials for application in coal gasification.** Natesan, K. (Argonne National Lab., IL). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The work provides a basic understanding of the corrosion behavior of commercial and model alloys after exposure to multicomponent gas mixtures. The information generated also provides a rational basis for the extrapolation of corrosion rates as a function of temperature, alloy composition, and chemistry of the gas environment. The mechanical test program will establish the influence of complex gas atmospheres on the uniaxial tensile and creep-rupture properties of selected iron- and nickel-base alloys with fairly high concentrations of chromium. The results from the analysis of the high-Btu systems have clearly established that the environments in coal-conversion processes can vary widely in gas composition, and therefore, the corrosion behavior of materials in different processes will vary even for identical temperature and pressure conditions. The thermodynamic potentials of oxygen, sulfur, and carbon in the product gas were established from the room-temperature compositions estimated for the different processes and the chemical equilibria that occur between various gas species at the process temperature and pressure. To verify the achievement of equilibrium in the gas phase of a multicomponent gas mixture, experiments have been conducted in the past year to measure oxygen partial pressures at elevated temperatures using a solid electrolyte cell.

40085 (CONF-811061—, pp II.61-II.72) **Corrosion of alloys for tar sands systems and in situ gasification.** Loop, R.B. (EG and G Idaho, Inc., Idaho Falls). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

No material evaluated in this program, with the exception of failed downhole components, showed unacceptable general corrosion. This finding was not unexpected, considering the relatively low temperatures in the aboveground product gas line portion of the system. Further, there was no evidence of significant pitting corrosion, intergranular attack, or carburization or decarburization. However, the apparent potential for loss of the flame-sprayed coating on the 316 SS specimens and the preferential attack experienced by the Alonized 316 SS specimens indicate that there may be no advantage to these particular techniques. It must be emphasized, at this point, that all three test exposures were for relatively short time durations. The materials examined in test (oil country tubular goods, 304L SS, 2-1/4 Cr-1 Mo, Hastelloy Alloys G, G-3, and C-276, Ferralium, and Haynes Alloy 20 Modified) experienced no significant general corrosion, and showed no indication of severe pitting, intergranular corrosion, stress corrosion cracking, or erosion.

40086 (CONF-811061—, pp III.25-III.31) **Biaxial testing of candidate coal gasifier alloys.** Horton, R.M. (EG and G Idaho, Inc., Idaho Falls). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The goal of this program is to measure the biaxial stress rupture strength, life, and ductility of four selected candidate coal gasifier alloys in various atmospheres intended to simulate a coal gasifier atmosphere (CGA). Baseline tests in air will show whether exposure to these simulated gasifier atmospheres has an adverse effect on these mechanical properties. This work is expected to confirm the results of uniaxial rupture tests in CGA being conducted elsewhere. It may also provide an empirical correlation between biaxial and uniaxial rupture strength. The alloys being tested are type 310 stainless steel; Incoloy 800H, both bare and Alonized; Haynes 188; and IN-657.

40087 (CONF-811061—, pp III.68-III.80) **Corrosion in coal liquefaction processes.** Lyle, F.F. Jr.; Arey, R.W.; Adams, L.M. (Metal Properties Council, Inc., New York, NY). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The objectives of this program are to: determine the general susceptibility of carbon steels, stainless steels, and nickel-base alloys

to corrosion in coal liquids; identify and measure concentrations of suspected corrosive species in coal liquids before and after corrosion tests; determine effects of temperature on the corrosion of metals and on the stability of corrosive species in coal liquids; relate extent, type of corrosion, and corrosion mechanism(s) to corrosive species present in coal liquids; and provide background data for the interpretation of results of in-situ corrosion tests and failures in liquefaction plants. Analyses of as-received coal liquids are being made to determine concentrations of the following suspected corrosive species: total nitrogen, chlorine compounds (total chlorine and organic chlorides), oxygen compounds (organic acids, phenols, water), sulfur compounds (total sulfur, hydrogen sulfide, elemental sulfur (including reactive polysulfidic sulfur) mercaptans, disulfides, including nonreactive polysulfidic sulfur and disulfides formed by removal of sulfur from reactive polysulfides. Corrosion coupon exposures of six alloys are being performed in coal liquid samples. The test alloys used in the coupon exposures are separated into two groups. Group I is composed of ferritic alloys including carbon steel (A515, Gr. 70), 5 Cr-1/2 Mo steel (A387, Gr. 5) and Type 410 stainless steel. Group II consists of austenitic alloys which are expected to be less susceptible to corrosion. Included in Group II are Type 316 stainless steel, Hastelloy C-276 and Incoloy 825. Relatively low corrosion rates have been measured in some of the coal liquids on all of the test alloys.

40088 (CONF-811061—, pp III.81-III.88) **Behavior of materials in synthetic fuels production environments.** Levy, A.V. (Lawrence Berkeley Lab., CA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

It has been determined in the past year that steel alloys with similar hardnesses but marked variations in other properties undergo erosion weight losses in a 30 wt % coal-kerosene slurry at room temperature that differ by up to 100% between alloys after 2 hours of erosion. The effect of coal concentration in coal-kerosene slurries on the behavior of mild and stainless steels has been determined to be significant between 20 wt % and 50 wt % slurries, particularly at higher slurry velocities. Alloys tested have included mild steel, 1075 carbon steel, chromium bearing low alloy steels with contents ranging from 1 1/4 Cr to 9 Cr, 410 ferritic stainless steel and 304, 310, 316 and 321 austenitic stainless steels. The erosion behavior of steels impacted by non-recirculating slurries from a nozzle directed at the specimen under varying velocities, impingement angles and coal concentrations have been determined at room temperature. Mild steel, 6061-T6 aluminum and several 300 series stainless steels have been tested. The results indicate a marked difference in the mechanism of erosion between gas-solid particle flows and liquid-solid particle flows. The effects of shale and retorting variables such as shale sulfur content, exposure temperature and time and oil content of the shale on the corrosion behavior of 14 different alloys have been investigated. In addition, several types of aluminized mild and stainless steels whose coatings were applied by several different processes have been studied in underground retorts, above-ground simulated retorts and in laboratory, bench scale apparatus.

40089 (CONF-811061—, pp III.134-III.135) **Mechanical and physical properties of materials.** Prager, M. (Metal Properties Council, Inc., New York, NY); Wells, C.H. 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The initial objective of the program has been to screen the mechanical properties of alloys of interest for gasifier internals with respect to degradation of properties at temperatures and pressures in typical high-Btu gasifier atmospheres. Both mechanical and physical property data have been generated. The mechanical properties of concern in design are creep and stress-rupture lifetime, tensile strength and ductility, impact energy, and low-cycle fatigue. Most of the effort has centered upon obtaining comparative stress-rupture data in air at one atmosphere and at 68 atmospheres in the MPC synthetic coal gas atmosphere at temperatures of 1200, 1500 and 1800°F. Samples of 310 Stainless Steel, Incoloy 800H, RA-333 and IN 657 which had been stressed to rupture in the CGA environment at 1500°F were examined using optical microscopy, scanning electron microscopy (SEM) and energy dispersive x-ray spectroscopy. Examination revealed that considerable environmental attack occurred during testing. IN 657 experienced the least attack while RA-333 and Incoloy 800H experienced the most severe attack. All four alloys developed a chromium-rich oxide scale during exposure. There was also evidence that a nickel-rich sulfide layer had been present on the outside of the oxide scale in RA-333. There was no evidence of a nickel sulfide layer in the other alloys. Internal oxides (chromium rich with small amounts of sulfur) were formed in these alloys. Oxidation was most severe along grain and twin boundaries. In RA-333, 310 stainless steel and Incoloy 800H chromium rich carbides were preferentially oxidized. Chromium rich sulfides were also present beneath the oxide scale in these three alloys. These alloys also experienced considerable carburization resulting in increased carbide precipitation.

40090 (CONF-811061—, pp IV.1-IV.11) **Gaseous corrosion resistance of refractories for coal gasifiers.** Heystek, H.; Raymon, N.S. (Tuscaloosa Research Center, University, AL). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The corrosion resistance of refractories and alloys to coal gasification atmospheres was studied, in particular with respect to the corrosive effects of carbon monoxide and steam (alone and in combination) and of chars (alkalis metal compounds in the chars). (LTN)

40091 (CONF-811061—, pp IV.12-IV.22) **Selection of refractories for slagging coal-conversion systems.** Kennedy, C.R. (Argonne National Lab., IL). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The primary objectives are to (1) determine which refractories are most likely to withstand the environment expected in coal-conversion plants where slagging conditions exist, and (2) identify grain-bond systems that have potential for improved refractory performance. Refractory bricks supplied by commercial vendors are being evaluated for use under slagging conditions. A variety of refractory compositions are being exposed to both basic and acidic slags in laboratory corrosion tests with and without water cooling. Samples of refractories that have been in service in pilot plants have also been obtained for examination. Attack mechanisms are determined through post-test metallographic, SEM, x-ray, and microprobe analyses. The most promising refractories will be subjected to longer-duration exposures in a large-scale test facility currently being built at IITRI.

40092 (CONF-811061—, pp IV.23-IV.28) **CO disintegration of coal gasifier refractories.** Brown, J.J. (Virginia Polytechnic Inst. and State Univ., Blacksburg, VA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

CO disintegration of high alumina castables is not likely to be a problem in gasifiers operating at or near atmospheric pressure provided the free iron content of the raw materials is kept low. This conclusion is based on experimental data presented previously. CO disintegration is a potentially serious problem at high pressures; refractory deterioration has been repeatedly observed in test samples after only 50 hr exposures to pure CO at 1000 psi. During the past year this investigation has concentrated on the effects of steam, H_2S, and H_2 at 1000 psi/500°C/50 hrs on the CO resistance of the high alumina castables. CO disintegration did not seriously affect the refractories when Fe_2O_3 additions were present; metallic iron additions, however, resulted in complete disintegration of these refractories and it would appear that any metallic iron present will promote disintegration. Hydrogen sulfide is effective in reducing the CO disintegration of the castables examined. Additions of 0.1% iron did, however, still result in complete disintegration of practically all samples examined. EDAX examinations show that iron is concentrated in the carbon deposit and the refractory around the carbon deposit is depleted in iron (as compared with an unexposed sample). It appears that the iron in the vicinity of a carbon deposit migrates to the site of carbon deposition and, in fact, each carbon filament contains an iron particle (catalyst) on its head which is

pushed forward as the filament grows. The catalyst was found to be elemental iron, not iron oxide sulfide or carbide.

40093 (CONF-811061—, pp IV.29-IV.35) **Analysis of refractory design for slagging gasifiers.** Snyder, J.E.; Henderson, J.F.; Jespersen, N.V. (Babcock and Wilcox Research and Development Div., Lynchburg, VA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

An investigation was conducted to determine if the brick-mortar lining of a gasifier can be modeled as an isotropic material. A two dimensional plane stress finite element model of a brick and mortar configuration was used to obtain the equivalent orthotropic properties which characterize the material properties of the brick and mortar in the axial and circumferential directions of the gasifier. These orthotropic material properties were then used in an axisymmetric model of a gasifier having a brick and mortar working lining and an insulating castable lining encased in a steel shell. The axisymmetric model was subjected to a thermal load and stresses in the linings were calculated. Stresses from this model were within 5% of an axisymmetric model of a gasifier having isotropic material properties obtained from the plane stress model described above. Therefore, it was concluded that in order to evaluate the elastic behavior of linings, an isotropic material can be used for the brick and mortar. This isotropic material must have properties equal to those for the brick and mortar in the axial direction of the gasifier. A computer program was developed to calculate temperatures and elastic stresses in the linings and the shell. A series of finite element models of brick and mortar was also investigated in order to predict the elastic properties of a combined layer of mortar and brick. A closed form analytical expression was developed for the elastic properties from this expression compared within 5 percent of those obtained from the finite element analysis.

40094 (CONF-811061—, pp IV.36-IV.38) **Refractories in slagging gasifiers.** Muan, A. (Pennsylvania State Univ., University Park). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Coal gasifiers operated at sufficiently high temperatures (~ 1400°C) to reject the coal ash in the form of a liquid phase (slag) place heavy demands on the refractory materials used for lining the reaction vessels. The objectives of the present research are to determine the chemical constraints affecting the performance of refractory materials under experimental conditions corresponding to those prevailing in slagging gasifiers, and to provide guidelines for selecting optimum compositions of such refractories. Testing of slag attacks on refractories under atmospheric conditions closely resembling those of coal gasifiers have established that chromium oxide-containing refractories show particular promise for use in high-temperature, slagging gasifiers. The present research is concerned with stability relations among various refractory components and their reaction products with slags, under temperature-atmosphere conditions approximating those encountered in coal gasification processes. Specifically, the investigation is concerned with stability relations among phases in the Ca, Mc, Fe, Al, Cr, Si oxide system. In order to decipher relations in this enormously complex system, the investigation must proceed in steps from the bounding ternary systems via the quaternary systems to the multicomponent systems, viz. Ca, Al, Cr oxides to Ca, Al, Cr, Si oxides to systems containing more than four components. The work has been expanded recently to include studies of iron oxide-containing systems, e.g. Ca, Fe, Al, Cr, Si oxides.

40095 (CONF-811061—, pp IV.39-IV.51) **Creep behavior of monolithic refractory materials.** McGee, T.D.; Symth, J.R. (Iowa State Univ., Ames). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Refractory concretes appear to be prime candidate materials for the linings of dry ash coal gasification pressure vessels. Due to the extreme conditions in the gasification process (temperatures to 1200°C, stresses to 2000 psi, corrosive atmosphere), it is important to have available high-temperature high stress creep data for these materials. Not only are data important but also information on the mechanisms of creep is desirable. The three main objectives of this research are: (1) to evaluate the short- and long-term creep behavior of refractory concretes utilized in the linings of coal gasification process vessels as related to starting composition, microstructure, and microstructural changes, (2) to determine the creep mechanisms in these materials as a function of composition and stress-strain/temperature history, (3) to obtain data that can be used in mathematical models. Steady-state strain rates were measured as a function of stress and temperature. The constant stress-variable temperature data were examined and found to have a linear dependence with inverse absolute temperature. The constant-temperature, variable-stress data were examined and found to have a linear dependence on the ln stress. From these results, an empirical model was developed for steady-state strain rates (in an Arrhenius form): steady state strain rate = A (stress)/sup n/ exp (-ΔH/RT). This model is very similar to classical equations for creep but the stress exponent (n) cannot be related to classical mechanisms for creep. The activation energy, and the stress exponent, were found to depend on thermal and stress history.

40096 (CONF-811061—, pp IV.52-IV.64) **Refractory test facility.** Firestone, R.F. (IIT Research Inst., Chicago, IL). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The test system is designed to simulate, as closely as possible, the conditions to which a refractory liner will be exposed in a commercial-size, pressurized slagging gasifier. The important parameters are: temperature, pressure, gas composition, slag composition, temperature gradient, slag flow and velocity, size, liner configuration, and cooling system. Temperatures in slagging gasifiers range from 2400° to 3400°F and are set by the process conditions and liquidity of the coal slag. In general, a temperature is chosen at which the slag from the particular coal used will have a viscosity of 150 to 250 poises, or about that of honey at room temperature. The temperature range of the test facility is 2400° to 3400°F, with a nominal design temperature of 3000°F in the test section. Pressure in slagging gasifiers ranges from slightly negative to about 1000 psig and is determined by the process. The test facility pressure is from atmospheric to 100 psig. Gas composition in slagging gasifiers ranges from reducing to very reducing, depending upon the process. The test facility can produce the complete range of oxygen partial pressures found in gasifiers. Slag composition is determined by the particular coal used and can range from acid to basic. In a slagging gasifier, the slag composition is approximately constant since fresh, flowing slag is in contact with the refractory liner. Static slag can quickly become saturated with components from the refractory liner. Temperature gradient along the refractory liner in a slagging gasifier is very low since the unit is so large; the gradient through the liner thickness depends upon the cooling system, but can be quite high. The test facility has a specially-bricked test section with a low longitudinal gradient and an adjustable thickness gradient.

40097 (CONF-811061—, pp IV.65-IV.IV.82) **Behavior of coal gasification vessels.** Buyukozturk, O.; Tseng, T.M. (Massachusetts Inst. of Technology, Cambridge). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The objectives of this study are: (a) to develop a numerical model to predict the stress and strain distribution during the heat-up and cooldown cycles of refractory concrete lined coal gasification vessels, (b) to provide a behavioral understanding of the degradation process in concrete such as cracking and creep, and (c) through parameter studies to arrive at specific guidelines for an optimal design.

40098 (CONF-811061—, pp VI.38-VI.40) **Failure prevention and analysis in coal liquefaction systems.** Keiser, J.R.; Baylor, V.B.; Swindeman, R.W.; Allen, M.D. (Oak Ridge National Lab., TN). 1981. NTIS, PC A24/MF A01. Contract W-7405-ENG-26.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

This task is aimed at improving materials performance and operating lives in large coal liquefaction plants through a careful metallurgical examination of components and surveillance coupons taken from pilot plants and process development units. Pilot plant and process development unit materials experience for liquefaction and other fossil energy systems can provide some of the most important and practical guidance for later plants. Oak Ridge National Laboratory examined failed or used components and surveillance coupons from operating plants. The objectives are to: obtain materials-related data and experience that can assist in the selection of materials for and in the design, construction, and operation of later plants; provide assistance to plant operators by providing failure analyses; and provide permanent records of significant results for incorporation in the Central Failure Analysis Data Bank operated at the National Bureau of Standards. Components and samples are provided by plant operators and are examined by appropriate methods. In addition, in-place nondestructive evaluations and/or metallographic examinations are performed at the plant sites upon request of the operators.

40099 (CONF-811061—, pp VI.52-VI.60) **Materials for radiant coolers of entrained slagging gasifiers.** Perkins, R.A. (Lockheed Palo Alto Research Labs., CA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

A total of 24 different alloys and coating systems were selected for testing in four different gas compositions. Thermodynamic phase stability considerations indicate that only titanium, aluminum, aluminum-rich coatings, and high chromium alloys will be capable of forming protective oxide scales under these exposure conditions. Sulfide scales will be in stable equilibrium with the gas on all low alloy steels, low chromium steels (<12%), and the copper base brasses and bronzes. Available kinetic data, however, indicate that the rate of sulfidation at these temperatures may be comparatively slow and the surface recession encountered may be within acceptable limits (<20 mpy). The first 1500 h screening tests have been completed and an analysis of the results produced a number of unexpected behavior patterns. External sulfide or oxide sulfide scales were formed on all high chromium stainless steels including Alloy 800, 310SS, and HK40-2.4Si. Stable oxide scales were formed only on the surface of aluminum and high aluminum coatings, titanium, and Naval Brass (Cu-37% Zn). The latter was expected to form a sulfide scale based on thermodynamic considerations but instead formed a stable, protective zinc oxide (ZnO) scale. Thermodynamic data used to calculate phase stability diagrams for the Zn-S-O system do not appear to be correct. The rate of surface recession for those alloys that formed sulfide scales was unacceptably high (>30 mpy) for the low alloy and 12% Cr steels at 752 to 932°F (400 to 500°C) but was very low (<10 mpy) for the high chromium (18% Cr or more) ferritic and austenitic stainless steels.

40100 (CONF-820304—17) **Chemistry of coal gasification.** Vorres, K.S. (Institute of Gas Technology, Chicago, IL (USA)). 1982. 15p. Inst. of Gas Tech., 3424 South State St., Chicago, IL 60616.

From 183. American Chemical Society annual meeting; Las Vegas, NV, USA (27 Mar 1982).

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Coal is a complex solid material containing a mixture of substances that chemically consist mostly of carbon with lesser amounts of hydrogen, oxygen, nitrogen, sulfur, and ash. Gasification is the conversion of solid coal to combustible gases by combining the carbon with additional oxygen and/or hydrogen. Although thermal decomposition (pyrolysis) can produce gaseous fuels, they are usually produced by reaction with oxygen, hydrogen, steam and carbon dioxide. The elemental composition range of coal and several combustible gases that may be derived from coal are given. At one extreme, the sole addition of oxygen provides carbon monoxide, the main component of a fuel gas called producer gas. At the other extreme, the addition of only hydrogen provides methane, the main constituent of substitute natural gas (SNG). In between these extremes, the addition of both oxygen and hydrogen provides a mixture of CO and H_2, which can be used either for fuel or for a chemical feedstock (synthesis gas or syngas). Coal gasification is carried out at high temperatures and chemical heat effects play an important part in controlling the process as well as providing for the process energy needs. The most important reactions for gasifying carbon are given in Table 2. Combinations with oxygen result in heat evolution (exothermic reactions). Conversely, the reaction of carbon with steam ($H_2O(g)$) to form H_2 and CO or to form H_2 and CO_2 requires the input of heat (an endothermic reaction). Also, carbon may be gasified by the direct addition of hydrogen (hydrogasification) to form methane (an exothermic reaction) or by CO_2 to form CO (an endothermic reaction). Most gasification processes are controlled by balancing the heat effects of the exothermic and endothermic reactions.

40101 (CONF-8110190—1) **Hydrogasification PDU studies.** Mensinger, M.C.; Lau, F.S.; Punwani, D.V. (Institute of Gas Technology, Chicago, IL (USA)). Oct 1981. 11p. Inst. Gas Technology, 3424 South State Street, Chicago, IL 60616.

From 4. technical contractors' conference on peat; Bethesda, MD, USA (22 Oct 1981).

In this program, hydrogasification tests are being conducted in two separate tasks which are (1) to study the gasification characteristics of Florida and Alaska peats, and (2) to determine the effects of dewatering methodologies on the gasification characteristics of peat. Three dewatering methods have been selected for testing. Hydrogasification tests with Florida (Seffner, Florida) peat have begun. Three tests have been completed. Table 1 summarizes the results obtained from the tests together with their corresponding operating conditions. A typical chemical analysis of this Florida reed sedge peat is shown in Table 2. Seven samples of Alaska peat were received and analyzed and fuel grade (< 25% ash and > 8000 Btu/lb) quality peats were identified. Bulk shipment of the fuel grade Alaska peat to IGT is underway. Tests to determine the effects of dewatering methodology on peat hydrogasification for North Carolina sod peat were completed. Tables 3 and 4 summarize the results of these tests and a comparison of the chemical analyses of the North Carolina milled and sod peats, respectively.

40102 (CONF-8110201—1) **Biomethanation of peat.** Ghosh, S. (Institute of Gas Technology, Chicago, IL (USA)). Oct 1981. 24p. Inst. Gas Technology, 3424 South State Street, Chicago, IL 60616.

From International peat symposium; Bemidji, MN, USA (21 Oct 1981).

The United States has vast reserves of peat that could be tapped for synthetic fuel production to augment our indigenous energy supply. The feasibility of methane production by anaerobic digestion is reviewed in this paper. Results of digestion studies conducted to study the effects of digestion mode, inoculum source, fermentation temperature, digester loading, hydraulic retention time, external nutrients, peat particle size, and acid and alkaline pretreatment of feed are discussed. Enhanced methane production was obtained at an acidic pH, with external nutrients, and when the peat was pretreated with alkali or acid.

40103 (DOE/ET/10104—50) **Solvent refined coal (SRC) process. Effect of mixing energy on hydrogen reaction rates in SRC-II reactors.** Singh, C.P.P.; Shah, Y.T.; Carr, N.L. (Pittsburg and Midway Coal Mining Co., Englewood, CO (USA)). Jan 1982. Contract AC05-76ET10104. 40p. NTIS, PC A03/MF A01. Order Number DE82008447.

This study attempted to analyze theoretically the conditions which may lead to hydrogen starvation in SRC-II reactors. Literature correlations for mass transfer coefficients in bubble columns were combined with experimental data from a stirred vessel (CSTR) on the basis of specific power consumption. Specific power consumption, i.e., consumption of mixing energy per unit volume per unit time, is proportional to N^3, where N is the stirred speed, and approximately proportional to superficial gas velocity (Ug) in a bubble column. For operating conditions selected to give maximum practicable reaction rate, i.e., under conditions of highest possibility of hydrogen starvation, results indicate that the fractional decrease in the rate of reaction would be insignificant (<4%) for superficial gas velocity, Ug, above 1 cm/s. Based on this result it can be claimed that in the SRC-II process, hydrogen starvation is unlikely. The rate of reaction was shown to be sensitive to the value of the mass transfer coefficient, K/sub L/a. A decrease in the rate of reaction due to lower value of mass transfer coefficient (K/sub L/a)

can be compensated by increasing the gas rate (superficial gas velocity). This shows that the possibility of hydrogen starvation would decrease with increase in the length of SRC-II reactors, since the superficial velocity in a taller reactor will have to be higher. Based on the present study, it is believed that the higher the gas velocity (the longer the reactor) in the large-scale reactor situation, hydrogen reaction rates will not be significantly influenced by mass transfer in normal operation of the reactor.

40104 **(DOE/ET/10104—54) Solvent Refined Coal (SRC) process: catalytic effect of iron compounds in SRC-II processing. Topical report, January 1, 1980-February 28, 1981.** Sood, A.; Moon, W.G. (Pittsburg and Midway Coal Mining Co., Englewood, CO (USA)). Feb 1982. Contract AC05-76ET10104. 68p. NTIS, PC A04/MF A01. Order Number DE82009084.

This report presents the results of a catalyst screening program in which the effects of waste iron-containing compounds on SRC-II process yields were investigated. The project was funded by DOE for the period January 1, 1980 through February 28, 1981 as part of Contract No. DE-AC01-79ET10104 and the work was done in support of the proposed SRC-II demonstration plant at Morgantown, WV. Waste materials from various industries were tested in a continuous, single-pass, simulated SRC-II operation using a 1-l stirred tank reactor. Several laboratory-prepared catalysts were also tested for comparison. Magnetic bauxite from bauxite ore processing, BOF (Basic Oxygen Furnace) sludge and magnetite from the steel industry, and pyrite from Climax's molybdenum ore processing were found to be active waste-material catalysts, increasing total oil yields by 4 to 8% above the baseline. Laboratory-prepared iron precipitate, iron-alumina, and iron-silica catalysts were also shown to be active.

40105 **(DOE/MC/14400—05) Development of BEACON technology. Quarterly report, April-June 1981.** (TRW Energy Systems Group, Redondo Beach, CA (USA)). Dec 1981. Contract FC21-80MC14400. 73p. NTIS, PC A04/MF A01. Order Number DE82009126.

The BEACON process involves the catalytic deposition of carbon from a gas stream containing carbon monoxide, and subsequent exposure of this carbon to a gas stream containing hydrogen or steam at elevated temperature and pressure to produce methane. The steam gasification route currently is receiving the most attention. Results of second stage gasification tests with BEACON carbon over a range of temperatures in bench-scale equipment supported the earlier conclusion that steam gasification at two temperature levels has significant advantages over steam gasification at a single temperature in terms of gasification rates and methane yields. Laboratory experiments with promoted BEACON catalysts showed improvements in carbon deposition and gasification rates and reaction selectivities to carbon and methane. Multiple-cycle tests were performed on selected promoted catalysts. Laboratory experiments with a new catalyst preparation technique were encouraging, and a fractional factorial screening design was used to test the effects of six process variables on catalyst C77. Multiple-cycle performance tests on catalyst C77 were started in both the 1-1/2 inch and 4 inch fluid bed reactors.

40106 **(DOE/MC/14591—T1) Significant parameters in the catalyzed CO_2 gasification of coal chars.** Spiro, C.L.; McKee, D.W.; Kosky, P.G.; Lamby, E.J.; Maylotte, D.H.b. (General Electric Co., Schenectady, NY (USA). Research and Development Center). 1982. Contract AC21-80MC14591. 30p. NTIS, PC A03/MF A01. Order Number DE82008508.

Alkali and alkaline earth carbonates have been used to catalyze the CO_2 gasification of coal chars prepared by pyrolysis of Illinois No. 6 coal. We have found that alkaline earth carbonates are fair gasification catalysts, through throughputs are insensitive to loadings in the range of 5 to 20% by weight. The order of efficacy is Ba > Sr > Ca. Alkali carbonates are excellent catalysts, with throughputs showing a dependence on loadings and atomic number. In particular, at high loadings (20% wt) the order is Cs > K > Na > Li. As kinetic parameters for the alkali carbonate Boudouard reaction with coal chars differ significantly from that of graphites, an alternative redox cycle mechanism has been proposed involving an alkali hydride intermediate.

40107 **(DOE/MC/14593—T2) Mechanism of catalytic gasification of coal char. Quarterly technical progress report No. 4, 1 July-30 September 1981.** Wood, B.J.; Sancier, K.M.; Sheridan, D.R.; Chan, B.L.; Wise, H. (SRI International, Menlo Park, CA (USA)). 15 Nov 1981. Contract AC21-80MC14593. 31p. NTIS, PC A03/MF A01. Order Number DE82008687.

The objective of this study is to determine the mechanisms involved in the catalytic gasification reactions of coal char and to identify the specific reaction steps and the parameters that control the catalytic process. The catalytic process involves three phases, the char, the catalyst dispersion on the char surface, and the gaseous reactants. Progress reports are presented for the following areas of investigation: (1) chemical and physical changes in catalyst-impregnated char; (2) kinetics of gasification of catalyst-impregnated char; (3) surface area and gasification kinetics; and (4) identification of reaction intermediates in the solid. (ATT)

40108 **(DOE/MC/14593—T3) Mechanism of catalytic gasification of coal char. Quarterly technical progress report No. 3, 1 April-30 June 1981.** Wood, B.J.; Sancier, K.M.; Brittain, R.D.; Sheridan, D.R.; Wise, H. (SRI International, Menlo Park, CA (USA)). 15 Aug 1981. Contract AC21-80MC14593. 37p. NTIS, PC A03/MF A01. Order Number DE82008686.

Measurements of reaction kinetics and thermodynamics are major tools in our effort to identify reaction pathways and intermediate species involved in the steam gasification of catalyzed coal char. The kinetic measurements reveal the dependence of the gasification rate on the mass of char, on the catalyst loading (catalyst/C ratio), and on the steam partial pressure. The thermodynamic measurements provide information on gaseous species in equilibrium with the solid char under conditions of temperature and reactant partial pressure similar to those employed during gasification. These studies are being supplemented by several physical measurements on the chars, most conducted in situ to preclude changes caused by interaction of the active char with the ambient atmosphere. These measurements include: (1) determination of micropore surface area by BET-CO_2 isotherms; (2) determination of free radical-metal ion interactions in the catalyst-containing char, by electron spin resonance (ESR); (3) determination of the state of the catalyst after partial gasification by examination with x-ray diffraction. Progress reports are presented for the following programs: (1) gasification kinetics (steam concentration, char mass, catalyst loading); (2) thermodynamic measurements (apparatus, vaporization of potassium carbonate, equilibrium studies with char containing K_2CO_3, measurements with spheron-6 carbon containing K_2CO_3); (3) physical measurements (surface area measurements, x-ray measurements, free radicals in reacting carbon).

40109 **(DOE/MC/16026—T1) Coal gasification and tar-conversion reactions over calcium oxide. Quarterly progress report, August 1, 1981-October 31, 1981.** Longwell, J.P.; Chang, C.S.; Peters, W.A. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jan 1982. Contract AC21-81MC16026. 11p. NTIS, PC A02/MF A01. Order Number DE82008694.

The present research was undertaken to investigate the role and potential application of calcium oxide chemistry in gasification and pyrolysis of coal. Specific objectives are to study: (1) the relative selectivity of thermal reactions over calcium oxide, compared to other solids, in converting pyrolysis tar to light hydrocarbons and char; (2) the change in mutagenicity of the tars produced by pyrolysis over calcium oxide; (3) the effect of calcium oxide on methane and hydrogen production; and (4) the gasification rate of carbon deposited on calcium oxide; and (5) the change, if any, of the activity of calcium oxide with the time of use and with regeneration. Within this reporting period, major progress has been made on the design, specification and procurement of equipment for a laboratory scale research apparatus to obtain data on the above objectives. This research is important to the US coal gasification program because it could identify strategies for reducing tar and increasing light gas formation in first generation gasification and advanced gasification reactors, especially moving and fluidizing bed equipment, and for improving the by-product value of those tars

that do form. The net result could be improved operability and economics for available coal gasification equipment and for processes now under development.

40110 (DOE/MC/19167—1150) Performance of gas-atomized spray scrubbers at high pressure. Yung, S.C.; Parker, R.; Duncan, M.; Le, T.; Calvert, S. (Air Pollution Technology, Inc., San Diego, CA (USA)). 1 Jun 1981. Contract AC21-82MC19167;AC21-79ET14812. 159p. NTIS, PC A08/MF A01. Order Number DE82008940.

A large number of coal gasification processes being developed propose to use Venturi scrubbers for particulate removal at high pressures. Theoretical predictions based on existing Venturi models indicate that Venturi scrubber performance will deteriorate severely in these high gas pressure applications. An exploratory theoretical and experimental program was performed to study the effect of gas pressure on Venturi scrubber performance. Experiments were done on a 0.47 m^3/s (1000 acfm) pilot scale Venturi scrubber operating at pressures up to 10 atm. Efficiency-pressure drop relationships were established for the Venturi at different gas pressures. Experimental results confirmed that the performance of the Venturi scrubber deteriorates with increasing pressure. An engineering design model was developed. The model predicted a pressure drop which is close to that measured and a penetration higher than measured. More data are required to further refine and develop a reliable engineering design model for high pressure Venturi scrubbers.

40111 (DOE/PC/30021—T8) Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 October 1981-31 December 1981. Dyer, P.N.; Pierantozzi, R.; Brian, B.W.; Bauer, J.V. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Jan 1982. Contract AC22-80PC30021. 82p. NTIS, PC A05/MF A01. Order Number DE82008247.

This program contains four major tasks: (1) Project Work Plan, (2) Slurry Catalyst Development, (3) Slurry Reactor Design Studies, and (4) Pilot Facility Design. In Task 2, five modified conventional catalysts were prepared, and six gas phase screening tests were carried out. One of these catalysts gave an excellent diesel fuel type product distribution, with a low CH_4 yield and good stability. Two slurry tests were run. The first used a 19 wt % slurry of ammonia synthesare catalyst as a baseline F-T case, and incorporated the slurry reactor mass transfer tests by varying stirring rates and space velocities as a function of temperature. Product distributions were straight line Schulz-Flory, as expected with this type of catalyst. The data are currently being analyzed to separate mass transfer and chemical rate effects. The second utilized a slurry of a coprecipitated catalyst, activated in the slurry phase. The pressure and temperature required for activation and reaction were found to be higher than for the gas phase screening tests, and deviations from the standard hydrocarbon product distribution were small. The usage and feed ratios were equal for 1:1 syngas. Seven supported cluster catalysts were synthesized and eight were screened in the gas phase. One of these produced a high selectivity to 1-butene and n-pentane. In Task 3, measurements of gas hold-up and solids dispersion in the 5" column were completed for the 45 to 53 μm and 90 to 106 μm iron oxide/isoparaffin systems. Contrary to the silica slurry results, an increase in gas hold-up was observed with a positive slurry velocity. No dependence of gas hold-up on distributor type was observed, however. With the 43 to 53 μm slurry, the solids concentration profiles were uniform under all conditions studied, but with the 90 to 106 μm slurry, a decrease in solids concentration with column height was observed at zero slurry velocity.

40112 (DOE/PC/30075—8) Crossed reaction networks in the catalytic hydrodenitrogenation of synthetic liquid fuels. Quarterly report, November 1, 1981-January 31, 1982. Satterfield, C.N.; Hsi, S. (Massachusetts Inst. of Tech., Cambridge (USA)). 1982. Contract AC22-80PC30075. 37p. NTIS, PC A03/MF A01. Order Number DE82008180.

Kinetic data obtained by reacting quinoline, BzTHQ (5,6,7,8-tetrahydroquinone) or alkyl anilines as a feed dissolved in a paraffin on a sulfided catalyst but in the absence of H_2S in the gas phase, have now been modeled by computer analysis. Comparison with previous vapor-phase studies showed that the presence of a liquid phase tends to equalize the adsorptivities of the various N-compounds. Hydrogenolysis reactions seem to be slightly slower in the vapor phase and hydrogenation reactions slightly faster, but the overall product distribution differs only slightly between the two phases. The equilibrium between quinoline and Py-tetrahydroquinoline is essentially the same in both phases and is rapidly attained in both. The addition of 5% tetralin to the paraffin carrier liquid had no noiceable effect on the reaction and tetralin itself remained essentially unreacted. Additional information confirms our earlier conclusion that propylcyclohexane is the principal saturated hydrocarbon formed by HDN but with increased contact time it isomerizes completely to butylcyclopentane. In the next quarter modeling of data obtained in the presence of H_2S will be pursued. Some scouting studies on the effects of oxygenated compounds on the HDN reaction will be made. We plan to study specifically benzodioxane, 2-ethylphenol, 3-ethylphenol, benzofuran, and 1-naphthol.

40113 (DOE/PC/40090—T1) Failure analysis of coal liquefaction slurry feed pump packing components. Lee, S.R.; Brackett, D.; Baldwin, K.L. (Mechanical Technology, Inc., Fairfax, VA (USA)). Feb 1982. Contract AC22-81PC40090. 36p. NTIS, PC A03/MF A01. Order Number DE82011900.

The root causes of the packing failures experienced at the coal liquefaction pilot plants are presented by five major hypotheses: insufficient packing lubrication, ineffective plunger flushing, unstable plunger alignment conditions of the pump, packing material incompatible to slurry and/or solvent, and undesirable packing installation, start-up, standby, and maintenance practices. These hypotheses will be used to guide the definition of test objectives for the laboratory and field tests of this program. Specifically, the planned test program is discussed briefly.

40114 (DOE/PC/40778—T2) Optimization of various coal-conversion systems. Quarterly report No. 3, November 1, 1981-January 31, 1982. Wen, C.Y.; Tong, T.; Huang, H.; Chen, H. (West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering). 1982. Contract FG22-81PC40778. 14p. NTIS, PC A02/MF A01. Order Number DE82008927.

In modeling three-phase flow reactors, mass transfer, heat transfer, interfacial area, and dispersion of phases as well as hydrodynamics have to be investigated. Flow regions based on two-phase flow (gas-liquid) of bubble columns have been studied. However, most of the studies have been based on the air-water system, which may differ significantly from the coal liquid-H_2 system. The applicability of these studies will be tested using experimental data from coal liquefaction studies. For three-phase fluidized bed reactors, flow regimes have not been well established. The published data and correlations will be used to examine their applicability to coal liquefaction processes.

40115 (DOE/PC/40785—2) Exploratory study of coal conversion chemistry. Quarterly report No. 2, August 19, 1981-November 18, 1981. (SRI International, Menlo Park, CA (USA)). 29 Jan 1982. Contract AC22-81PC40785. 37p. NTIS, PC A03/MF A01. Order Number DE82011703.

This report describes work accomplished under two tasks: Task A, mechanisms of donor-solvent coal liquefaction, and Task B, CO/H_2O conversion systems. Under Task A, we describe additional evidence relating to the question of the mechanism of the iron oxide catalyzed cleavage of hydroxydiphenylmethanes. o-Hydroxydiphenylmethane is relatively more sensitive to catalysis by Fe_3O_4, a possible one electron oxidant, and triphenylmethane is relatively more sensitive to catalyzed cleavage by SiO_2/Al_2O_3, a strong Bronsted acid catalyst. This provides further evidence that in the former case the reactions of radical cations are important in the cleavage mechanism. Tests with Cr_2O_3 show it to be ineffective under our reaction conditions as a catalyst for hydroxydiphenylmethane cleavage. We have also used the decomposition of diphenylether in tetralin, which we have previously shown to occur by a radical displacement reaction, as an indicator of steady state radical concentration in tetralin. The results of these experiments indicate that radical concentrations in tetralin are not significantly increased by spiking the tetralin with 1,2-dihydronaphthalene. This in turn suggests that rapid disproportionation of

1,2-dihydronaphthalene to tetralin and naphthalene takes place by way of a concerted reaction, in addition to a slower radical disproportionation process that may provide the steady state radical concentration supported by the equilibrium concentration of 1,2-dihydronaphthalene. Under Task B1, we have found a correlation between initial pH and CO pressure on the conversion of PSOC-26 coal to toluene soluble products. A pH dependence was also observed for PSOC-233 coal, similar to results with PSOC-26. Under Task B2, we have studied anisole as a model oxygen containing structure in coal.

40116 **(PB—81-180069) Effects of additives on methanation activity of Raney nickel catalysts. Report of investigations/1980.** Russell, J.H.; Oden, L.L.; Henry, J.L. (Bureau of Mines, Albany, OR (USA). Albany Research Center). 1980. 28p. NTIS PC A03/MF A01.

The Bureau of Mines, U.S. Department of the Interior, in cooperation with the Department of Energy, has attempted to increase the activity of nickel catalysts for converting synthesis gas, derived from coal, to a substitute natural gas. This report describes the effects of low-level additions of B, Ca, Ce, Co, Mn, Mo, Pd, Re, Ti, Y, Zn, and Zr on the methanation activity of Raney nickel. The methanation rate at 320 C and the resistance to poisoning by 2 ppm H2S were used to compare catalysts. The effects of the additions were small, and the experimental variances were large, necessitating the use of statistical methods to identify significant effects. Co, Ti, Y, and Zn improved the resistance to H2S poisoning, but only Co improved the methanation rate. In some individual catalysts containing Ca, Mo, or Mn, both the methanation rate and resistance to H2S poisoning were improved.

40117 **(PB—81-185613) Environmental assessment: source test and evaluation report, Koppers-Totzek process. Final report, August 1979-December 1980.** Zee, C.A.; Clausen, J.F.; Crawford, K.W. (TRW, Inc., Redondo Beach, CA (USA)). Jan 1981. 89p. NTIS PC A05/MF A01.

The report gives results of a source test program at a Koppers-Totzek (K-T) coal gasification plant operated by AECI, Ltd. at Modderfontein, Republic of South Africa. Much of the effort was focused on wastewater streams. Wastewater treatment, consisting of a clarifier and settling pond, was adequate to produce a final discharge that had lower pollutant levels than the fresh input waters supplied to the plant. The report contains complete data and describes the K-T process and the Modderfontein plant.

40118 **(PB—81-807992) Coke manufacture. 1974-July 1981 (citations from the Engineering Index data base). Report for 1974-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 379p. NTIS PC N01/MF N01.

Coke production from bitumens, coal, petroleum and lignite is covered in this compilation from worldwide research. Studies on coke oven design, performance, corrosion, and deterioration are cited. Blast furnace coke, additives, quality control, and chemical analysis are discussed. Byproduct recovery from coking processes is included. (This updated bibliography contains 369 citations, 110 of which are new entries to the previous edition.)

40119 **(PB—81-808024) Underground coal gasification. 1979-July 1981 (citations from the NTIS data base). Report for 1979-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 165p. NTIS PC N01/MF N01.

The bibliography of Federally-sponsored research cites many aspects of in-situ gasification techniques, including rock fracturing, combustion, gas removal, economics, costs, and environmental factors. (This updated bibliography contains 136 citations, 63 of which are new entries to the previous edition.)

40120 **(PB—81-808057) Coal liquefaction technology. May 1980-July 1981 (citations from the NTIS data base). Report for May 1980-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 199p. NTIS PC N01/MF N01.

This updated bibliography contains citations on the techniques and processes of the conversion of coal to liquid chemicals or fuels, theses are listed in title sequence. They cover most aspects of the processes including design, performance evaluation, cost analysis, and plant equipment. Coal desulfurization, cleaning, or preparation, which do not involve conversion to liquid fuels or chemicals, are not covered. (This updated bibliography contains 192 citations, all of which are new entries to the previous edition.)

40121 **(PB—81-808065) Coal liquefaction technology. May 1978-April 1980 (citations from the NTIS data base). Report for May 1978-April 1980.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 226p. NTIS PC N01/MF N01.

Studies on the techniques and processes of the conversion of coal to liquid chemicals or fuels are cited, listed in title sequence. They cover most aspects of the processes including design, performance evaluation, cost analysis, and plant equipment. Coal desulfurization, cleaning, or preparation, which do not involve conversion to liquid fuels or chemicals are not covered. (This updated bibliography contains 217 citations, none of which are new entries to the previous edition.)

40122 **(PB—81-808123) Underground coal gasification. 1970-April 1980 (citations from the Engineering Index data base). Report for 1970-April 1980.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 276p. NTIS PC N01/MF N01.

The bibliography presents worldwide research pertaining to underground (in-situ) coal gasification. It includes environmental effects, the different processes and techniques that are used, gas removal, rock fracturing, costs, and economics. (This updated bibliography contains 269 citations, none of which are new entries to the previous edition.)

40123 **(PB—81-808131) Underground coal gasification. May 1980-July 1981 (citations from the NTIS data base). Report for May 1980-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 110p. NTIS PC N01/MF N01.

The bibliography presents worldwide research pertaining to underground (in-situ) coal gasification. It includes environmental effects, the different processes and techniques that are used, gas removal, rock fracturing, costs, and economics. (This updated bibliography contains 103 citations, all of which are new entries to the previous edition.)

40124 **(PB—81-808149) Coal gasification technology. 1979-April 1980 (citations from the NTIS data base). Report for 1979-April 1980.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 224p. NTIS PC N01/MF N01.

Research reports on coal gasification are cited, listed in title sequence. They cover the techniques and processes of the conversion of coal to chemicals or fuels. Coal desulfurization, cleaning, or preparation, which do not involve conversion to gaseous fuels or chemical, are not covered. Also excluded are in-situ gasification studies. (This updated bibliography contains 214 citations, none of which are new entries to the previous edition.)

40125 **(PB—81-808156) Coal gasification technology. June 1980-July 1981 (citations from the NTIS data base). Report for June 1980-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 311p. NTIS PC N01/MF N01.

Research reports on coal gasification are cited, listed in title sequence. They cover the techniques and processes of the conversion of coal to chemicals or fuels. Coal desulfurization, cleaning, or preparation, which do not involve conversion to gaseous fuels or chemical, are not covered. Also excluded are in-situ gasification studies. (This updated bibliography contains 304 citations, all of which are new entries to the previous edition.)

40126 **(PB—81-865743) Supercritical gas extraction of liquids from coal. January, 1976-May, 1981 (citations from the Energy Data Base). Report for January 1976-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 51p. NTIS PC N01/MF N01.

Citations in this retrospective bibliogrpahy cover supercritical gas extraction theory, techniques, and technology for the extraction of liquids from coal. While coverage is worldwide, much attention is focused upon work being done in the United Kingdom. (Contains 42 citations fully indexed and including a title list.)

40127 **(PB—81-866071) Exxon Donor Solvent (EDS) coal liquefaction process development: reports. January, 1976-May, 1981 (citations from the Energy Data Base). Report for January 1976-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 70p. NTIS PC N01/MF N01.

This retrospective bibliography covers reports on government supported research and development of the Exxon Donor Solvent (EDS) Coal Liquefaction Process, Phases IIIA through V. Technical, environmental, economic, and commercial aspects of the Process are considered. (Contains 47 citations fully indexed and including a title list.)

40128 **(PB—82-800525) Desulfurization of coal and petroleum. 1978-September, 1981 (citations from the NTIS Data Base). Report for 1978-Sep 81.** (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 238p. NTIS PC N01/MF N01.

The bibliography covers aspects of coal and petroleum fuel desulfurization relating to coal preparation, coal liquids, the gasification of coal, and crude oil preparation, where the processes specifically accomplish desulfurization before combustion of the fuel. Coal liquefaction and gasification are only included if sulfur removal is stressed. Flue gas desulfurization and other post-combustion sulfur control processes are excluded. (This updated bibliography contains 231 citations, 58 of which are new entries to the previous edition.)

40129 **(SAND—81-2530) Catalytic effects in coal gasification. Quarterly report, January-March 1981.** Padrick, T.D.; Dees, D.D. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1981. Contract AC04-76DP00789. 17p. NTIS, PC A02/MF A01. Order Number DE82010940.

This summarizes the activities of Sandia National Laboratories' program on mineral matter effects in coal gasification. The objective of this program is to deverop a fundamental understanding of the mechanism of the catalytic effects of mineral matter on coal gasification, and to use this knowledge for future process improvements. We have performed experiments to ascertain the mechanism of the catalytic activity observed for various iron compounds and to optimize this catalytic activity. We determined that addition of Fe_2O_3 to Bruceton coal lowers the activation energy for char gasification in H_2 from 40 kcal/mole to 25 kcal/mole, suggesting a change in mechanism for the catalyzed system. We have also observed that for 5μ Fe_2O_3, a plateau in gasification rate ($\sim$ 20 times the non-catalytic rate) is reached at $\sim$ 5% by weight loading. Studies on improved catalyst dispersion techniques have shown that vacuum impregnation of coal by $FeSo_4$ results in a gasification rate 4 times greater than if $FeSO_4$ is dry mixed with the coal, but is still about one-half the gasification rate for dry mixed Fe_2O_3.

40130 **Desulphurization of solid fuels in power stations with superconducting magnets.** Monostory, F.P.; Knoll, M.; Seidel, M.; Doerr, H.; Supp, A. Berlin, Germany, F.R.; Umweltbundesamt (1980). 54p. (In German).

This paper describes investigations for: separation of pyrite from the coarse fraction of the air classifier of the coal dust roller mills with superconducting magnetic separators; development of a sampling device for reduced pyrite content of these fractions; development of the superconducting magnetic separation device; setting up and testing of a pilot plant consisting of a roller mill and a superconducting magnetic separator; and includes an economic forecast for the application of this device. (27 refs.) (In German)

0105 By-products

40131 **(PB—81-177412) Materials balance for benzene: Level II. Final report.** Hall, R.L.; Burger, R.; Montecalvo, F. (JRB Associates, Inc., McLean, VA (USA)). May 1980. 242p. NTIS PC A11/MF A01.

A Level II materials balance was performed on benzene. Data are reported for benzene production from petroleum by four processes (catalytic reformation, toluene dealkylation, toluene disproportionation, and isolation from pyrolysis gasoline) for production from coal during coking. Amounts of benzene consumed for the synthesis of eight direct derivatives (ethylbenzene, cumene, cyclohexane, nitrobenzene, maleic anhydride, mono- and dichlorobenzene, alkylbenzenes, and biphenyl) and exports are presented. These uses constitute approximately 99 percent of total benzene usage. Nonconsumptive uses (solvents and pesticide component) are also tabulated. Releases due to each of the above processes are reported or estimated where possible using published and unpublished data. In addition, releases due to indirect production (refinery operation, coke oven operations, oil spills, non-ferrous metals manufacturing, ore mining, wood processing, coal mining, and two phases of the textile industry) are presented. Production of benzene as a component of gasoline and releases due to all phases of gasoline use are estimated. Locations of sites with high levels of benzene releases due to production and use are tabulated: the major 'hotspots' are Baton Rouge, Louisiana; Houston/Galveston, Texas; Midland, Michigan; and Puerto Rico. The uncertainty ranges of all numbers used or derived in this report are evaluated when possible and tabulated. Data gaps are evaluated and general recommendations are presented. The results of the report are summarized in two figures: the Environmental Flow Diagram for benzene in Appendix A, and the Materials Balance Flow Diagram in the Executive Summary.

0106 Properties

REFER ALSO TO CITATION(S) 40100, 40101, 40115, 40158, 40159, 40171, 40196, 41172

40132 **(DOE/ER/10840—1) Anisotropic elasticity of coals. Progress report, 1 February to 30 September, 1981.** (Kentucky Univ., Lexington (USA). Research Foundation). 1981. Contract AS05-81ER10840. 49p. NTIS, PC A03/MF A01. Order Number DE82008293.

The research performed under this contract, during this initial period, has progressed steadily and satisfactorily towards meeting the contract goals. The program steps that have been accomplished include the fabrication (final stage) and calibration of a multiaxial loading cell, the development of an initial site for collection of coal samples, and the elaboration of a protocol for the preparation and preservation of coal specimens. The research program aims at the determination of the anisotropic elastic constants of various coal by static methods, and later by ultrasonic measurements of elastic wave speeds. In addition, these elastic properties will be correlated with structural properties of the various coals in search of valid connections between elastic moduli and other more readily determined material properties. To date, progress has only been towards the static measurements goal.

40133 **(DOE/PC/30223—3) Petrographic characterization of Kentucky coals. Quarterly progress report, December 1981-February 1982.** Hower, J.C.; Ferm, J.C.; Cobb, J.C.; Trinkle, E.J.; Frankie, K.A.; Poe, S.H.; Baynard, D.N. (Kentucky Univ., Lexington (USA)). 1982. Contract FG22-80PC30223. 10p. NTIS, PC A02/MF A01. Order Number DE82008697.

The project involves three specific areas of coal petrology: spectral fluorescence of liptinite macerals; properties of semi-inert macerals; and size/form/microlithotype association of pyrite/marcasite. Additional research on the Mannington and Dunbar coals in western Kentucky will apply techniques developed in the first three areas. Suites of coals from other states will also be studied to expand the variability for the project which involves the determination of coal rank through the use of fluorescence measurements on sporinite, all samples have been studied and data analysis is still in-

complete. Interpretation of results will be presented in future reports. The actual developments of pseudovitrinites are being investigated. Two possible mechanisms for the origin of pseudovitrinites have been suggested. The first mechanism is differential coalification of similar materials. The second factor for influencing the development of pseudovitrinite is an actual difference in original plant composition. Pyrite analysis of western Kentucky coals has been completed, however data reduction is still incomplete. Changes in the petrography of western coals may be related to depositional environments of the coal.

40134 **(DOE/PC/40266—2) Measurement of fundamental properties characterizing coal minerals and fireside deposits. Second quarterly technical progress report, 1 July 1981-30 September 1981.** Wagoner, C.L. (Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.). Jan 1982. Contract AC22-81PC40266. 17p. (ARC-LR—82-4696-01-01). NTIS, PC A02/MF A01. Order Number DE82008195.

This report is the second quarterly technical progress report on a project to develop detailed data on the physical characteristics and mineral constituents of a low-rank coal and of the surface deposits and flyash which result from burning the coal. It covers the progress made during the period July-September 1981. Milestone 1a, Fuel Selection, activities resulted in selection of coals for the test program by DOE. Work at B and W started the process of procurement of coal samples. Under Milestone 2, Mineral Identification and Production of Mineral Modified Coal, a subcontract between Babcock and Wilcox and Penn State University was fully executed by both parties and sent to DOE for approval. Work is in progress and continues on schedule for Milestone 3a, Combustion Facility Preparation. Final design and fabrication of parts for modification of the B and W combustion facility are about 95% complete.

40135 **(DOE/PC/40810—1) Synthesis of oligomeric models of coal derived materials for use with GPC calibration. Quarterly reports, September 1981-February 1982.** Baltisberger, R.J.; Jones, M.B. (North Dakota Univ., Grand Forks (USA). Dept. of Chemistry). Mar 1982. Contract FG22-81PC40810. 18p. NTIS, PC A02/MF A01. Order Number DE82008882.

One important facet of the characterization of coal derived materials is that of molecular weight determination. Number average molecular weight is usually obtained by vapor pressure osmometry measurements. However, no satisfactory method is available for determining weight average molecular weights. The latter values are useful in predicting rheological properties. Gel permeation chromatography (GPC) is a technique which should be most readily adaptable for this measurement. The other techniques of ultracentrifugation and light scattering are not as readily available as GPC. At this time, satisfactory calibration standards which possess chemical structures similar to coal derived materials are non-existent. The purpose of this study is to develop a useful set of GPC calibration standards for asphaltene and preasphaltene analyses. Our previous results suggest models in which coal derived preasphaltenes and asphaltenes are composed of oligomeric aromatic ethers of both diaryl and furan types. We plan to synthesize a series of model oligomers that are in agreement with the average structural formulas of some selected coal preasphaltenes as determined by pmr, elemental analyses and various oxygen derivatization procedures. These model compounds will be tested for use as calibration standards for both high pressure gel permeation chromatographic and vapor pressure osmometric procedures. Their response and retention times will be compared with coal preasphaltenes to determine the suitability of the model compounds as calibration standards.

40136 (LMF—91, pp 339-341) **Physical characteristics of fly ash from a 9-foot^3 FBC: preliminary report.** Carpenter, R.L.; Newton, G.J.; Barr, E.B. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Preliminary characterization of aerosols from a 9-foot^3 atmospheric pressure fluidized bed combustor revealed a similarity in fly ash morphology with fly ash from the 1-foot^3 experimental combustor studied previously. Fly ash emission rates were higher on a mass/unit volume basis for the 9-foot^3 combustor.

40137 (LMF—91, pp 347-350) **Characterization of organic compounds in mutagenic extracts of fluidized bed combustion and pulverized coal combustion particles.** Hanson, R.L.; Henderson, T.R.; Clark, C.R.; Hobbs, C.H. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Mutagenic and nonmutagenic extracts of fly ash from pulverized coal combustion and fluidized bed combustion were analyzed by gas chromatography/mass spectrometry and mass spectrometry/mass spectrometry. Some indirect acting mutagens (requiring metabolic activation) were tentatively identified by gas chromatography/mass spectrometry. Nitro-derivatives of polycyclic aromatic hydrocarbons were detected in the extracts by mass spectrometry/mass spectrometry. It appeared that some of the direct-acting mutagens in these fly ash extracts may be products of reactions of polycyclic aromatic hydrocarbons with NO/sub x/ in the combustion gases.

40138 (LMF—91, pp 449-452) **Characterization of particles in high temperature-high pressure process streams of an experimental low Btu coal gasifier.** Newton, G.J.; Benson, J.M.; Cheng, Y.S.; Carpenter, R.L.; Henderson, R.F. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Entrained particles penetrating the first cleanup cyclone of an experimental low Btu coal gasifier were sampled with an experimental high temperature-high pressure (HTHP) cascade impactor. Stream conditions were 400 to 700°C and 9-13.6 atm. The cumulative mass distribution collected by the HTHP impactor indicated a mass median aerodynamic diameter (MMAD) of 2.81 +- 0.53 μm with a geometric standard deviation (σ/sub g/) of 2.48 +- 0.80 and a mass concentration of 5.0 x 10^{-3} g/cm^3. Elemental composition of size classified particles was determined by spark source mass spectrometry and atomic absorption spectroscopy. Particles larger than 4.2 μm were enriched in metals relative to smaller particles, presumably these metals were derived from corrosion or erosion of stainless steel in the process system.

40139 (LMF—91, pp 453-456) **Physicochemical characterization of low Btu coal gas combustion aerosols.** Cheng, Y.S.; Yeh, H.C.; Carpenter, R.L.; Newton, G.J. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Aerosols from combustion of low Btu gas produced by an experimental gasifier were characterized. Gas was combusted in a burner with or without premixed air and combustion products were diluted with filtered air. Size distributions of aerosols measured by an electrical aerosol analyzer (EAA) showed a bimodal distribution corresponding to nuclei and accumulation modes of condensation aerosols. Combustion aerosols were droplets and contained sulfur suggesting that this combustion aerosol may be sulfuric acid droplets or other sulfur compounds produced from oxidation of H_2S in the low Btu gas.

40140 (LMF—91, pp 457-463) **Chemical characterization of the process stream of an experimental low Btu coal gasifier.** Benson, J.M.; Hanson, R.L.; Royer, R.E.; Gunsett, S.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Process materials from coal gasifiers can pose a health hazard to workers, while combustion products may present a concern to both the environment and general population. Process stream material, clean gas and gas combustion products from an experimental coal gasifier were subjected to chemical analysis by a variety of analytical techniques. Several polycyclic aromatic hydrocarbons (PAH) were identified in process stream materials and in combustion gas products. Analysis of samples by infrared spectroscopy also indicated the presence of polar compounds which were

not detected by gas chromatography or gas chromatography/mass spectrometry. Combustion gas products, which were collected without a desulfurizer unit on line, had a 20-fold increase in sulfate ion over the concentration present in clean gas. Results reaffirmed that process stream materials contain potentially toxic PAH and that gas combustion products contain both PAH and sulfate ions. Process materials can pose a health hazard to workers, while combustion products may present a concern to both the environment and general population.

40141 (LMF—91, pp 464-468) **Lipid-soluble metal compounds in a coal gasifier.** Dahl, A.R. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Lipid-soluble compounds of iron, chromium, zinc and aluminum in coal gasifier tar were partially characterized chemically. Lipid solubility was inferred from n-octanol/water partitioning and benzene solubility tests. The ability of the compounds to remain lipid-soluble after treatment with acid and base was tested.

40142 **(PB—81-853848) Neutron activation analysis: minerals and ores. January 1970-November 1980 (citations from the NTIS Data Base). Report for January 1970-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 102p. NTIS PC N01/MF N01.

This retrospective bibliography is a survey of neutron activation techniques applied to the analysis of mineral deposits, ores, meteorites, and lunar samples. Topics such as characterization of coal liquification residues, mineral matter in coal, and the analysis of complex mixtures of rare earth elements are also included. (Contains 86 citations, fully indexed and including a table of contents.)

40143 **(PB—81-853855) Neutron activation analysis: minerals and ores. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 242p. NTIS PC N01/MF N01.

This retrospective bibliography is a survey of neutron activation techniques applied to the analysis of mineral deposits, ores, meteorites, and lunar samples. Topics such as characterization of coal liquification residues, mineral matter in coal, and the analysis of complex mixtures of rare earth elements are also included. (Contains 239 citations, fully indexed and including a table of contents.)

40144 **(PB—81-853863) Neutron activation analysis: minerals and ores. January 1972-November 1980 (citations from the International Aerospace Abstracts Data Base). Report for January 1972-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 63p. NTIS PC N01/MF N01.

This retrospective bibliography is a survey of neutron activation techniques applied to the analysis of mineral deposits, ores, meteorites, and lunar samples. Topics such as characterization of coal liquification residues, mineral matter in coal, and the analysis of complex mixtures of rare earth elements are also included. (Contains 56 citations, fully indexed and including a table of contents.)

40145 **Coordiated scanning electron microscopy and light microscopy for the evaluation of chemical element heterogeneity among individual fly ash particles.** Hayes, T.L. (Univ. of California, Berkeley); Lai, C.E.; Fisher, G.L.; Prentice, B.A. pp 254-255 of Thirty-eighth annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). New York, NY; Electron Microscopy Society of America (1980).

Particles of fly ash were analyzed by scanning electron microscopy (SCM) to evaluate the segration of chemical elements among the various types of fly ash particles previously identified by light microscopy. Eleven classifications of fly ash were investigated, and 15 individual particles from each class were selected for SCM analysis. Data are presented for the enhancement ratio (ratio of concentration in selected samples to average concentration from bulk analysis) for 8 elements: P, Mn, Ti, Fe, S, Mg, Ca, and K. The high degree of homogenity of the individual particles with respect to matric element composition was confirmed by the SCM data. (BLM)

40146 **Occurrence of duplex films on flyash surfaces.** Diamond, S.; Ravina, D.; Lovell, J. (Purdue Univ., West Lafayette, IN). *Cement and Concrete Research;* **10**: 297-300(1980). Contract EM-78-X-02-5027.

This note reports observations made on several flyash-bearing Portland cement pastes in which duplex films apparently are found to occur around all visible grains, including the flyash particles. The films consist of a thin 0.5 μm uniform continuous layer of calcium hydroxide deposited quickly on the exposed surface, plus a thin single layer of parallel, more-or-less widely spaced C-S-H gel particles. The pastes were 0.5 pastes prepared from 50 wt percent flyash-50 wt percent Portland cement mixtures hydrated for 1 day at room temperature. Examination suggests that the coating that develops around these flyash grains, which should be inert at the short period of hydration involved, is in fact the same kind of calcium hydroxide -C-S-H gel duplex film previously shown to form on any inert surface in contact with solutions developing in hydrating cement paste. The long term cementitious reaction, associated with the late strength gain of such flyash-containing concretes must take place through this skin, presumably by diffusion of material in or out of the grain through it. It appears that the same hydration shells may represent the effects of deposition from solution onto surfaces of grains that are chemically inactive. 3 figures. (DP)

0108 Waste Management

REFER ALSO TO CITATION(S) 40712, 40713, 40715, 41023, 41024

40147 **(PB—81-142655) EPA utility FGD survey: July-September 1980. Quarterly report.** Smith, M.; Melia, M.; Gregory, N.; Groeber, M. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Oct 1980. 343p. NTIS, PC A15/MF A01.

This report is the last of three supplements updating the October-December 1979 report (PB-80-176811) and should be used in conjunction with it. The report, which is generated by a computerized data base system, presents a survey of operational and planned domestic utility flue gas desulfurization (FGD) systems, operational domestic particle scrubbers, and Japanese coal-fired utility boiler FGD installations. It summarizes information contributed by the utility industry, process suppliers, regulatory agencies, and consulting engineering firms. Domestic FGD systems are tabulated alphabetically by development status (operational, under construction, or in planning stages), utility company, process supplier, process and waste disposal practice. It presents data on boiler design, FGD system design, fuel characteristics, and actual performance. It includes unit by unit dependability parameters and discusses problems and solutions associated with the boilers and FGD systems. Process flow diagrams and FGD system economic data are appended.

40148 **(PB—81-200420) Annotated bibliography of literature on flue gas conditioning (1966-1980). Final report.** Desai, P.R.; Sutherland, T.K.; Buonicore, A.J. (York Services Corp., Stamford, CT (USA)). Dec 1980. 141p. NTIS, PC A07/MF A01.

This report presents a comprehensive bibliography of literature on Flue Gas Conditioning. It was developed through search of numerous data bases including Air Pollution Abstracts (APTIC), Chemical Abstracts, Engineering Index (COMPENDEX), Environmental Abstracts (ENVIROLINE), National Technical Information Service (NTIS), etc. Publications of Electric Power Research Institute, Edison Electric Institute, and Department of Energy are also included. Information is provided on the assigned U.S. patents related to Flue Gas Conditioning. The literature is organized under four separate categories: (1) general theory, (2) specific methods and agents, (3) specific installations using FGC, and (4) legal and regulatory aspects.

40149 **(PB—81-244501) Coal waste dewatering systems. Open file report 11 December 1979-6 February 1981.** Jacobsen, S.P.; Roushey, W.; Rau, E.L. (Colorado School of Mines, Golden (USA). Research Inst.; Bureau of Mines, Washington, DC (USA)). Feb 1981. 133p. NTIS, PC A07/MF A01.

Samples of fine coal refuse were obtained from 11 coal preparation plants throughout the United States. The samples were characterized by ash analysis, particle size, and mineral composition. From the characterization, geographical locations, and the dewatering equipment being used by the plants, five sites were selected for obtaining bulk fine refuse samples. The selected coal preparation plants were used for final dewatering thickeners followed by a vacuum disc filter, a filter press, a belt press filter, a centrifuge, and a settling pond. None were using thermal drying. The moisture content of the final cake ranged from approximately 23 to 50 pct, depending upon the feed material, flocculant addition, and the type of equipment. The filter press gave the lowest moisture content followed by a belt press and then either a centrifuge or vacuum filter. The centrifuge products were all dried to an approximate 5-pct moisture in a thermal dryer.

40150 **(PB—82-101940) Investigation of the use of coal refuse-fly ash compositions as highway base course material. Final report Oct 77-Sep 80.** McQuade, P.V.; Head, W.J.; Anderson, R.B. (GAI Consultants, Inc., Monroeville, PA (USA)). Jun 1981. Contract DOT-FH-11-9324. 68p. NTIS, PC A04/MF A01.

The need to recycle waste products is becoming more crucial as the cost of their disposal escalates and the availability of conventional materials becomes scarce. Two such by-products of the coal industry, coal refuse and fly ash, have shown promise as construction materials. In view of the projected shift from oil to coal for electric power generation, the already abundant supply of both coal refuse and fly ash is expected to increase along with their disposal cost. This report outlines the findings of a study into the utilization of coal refuse-fly ash compositions as highway base course material. It includes a discussion of the results from an extensive laboratory testing program into the physical and engineering properties of mixtures of these waste products and a comparison of serviceability index and physical damage parameters based on the VESYS Predictive Design Procedure between crushed stone and coal refuse-fly ash compositions. These findings indicate that substituting stabilized coal refuse-fly ash blends in place of conventional base course material is technically and economically feasible. In-service usage of these stabilized mixtures should now be verified by appropriate field testing. The report also presents procedures for developing design mixes and conducting field tests of coal refuse-fly ash base course material.

40151 **(PB—82-106212) Limestone FGD (flue gas desulfurization) scrubbers: user's handbook. Report for Jun 80-Feb 81.** Henzel, D.S.; Laseke, B. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Aug 1981. Contract EPA-68-02-3173. 527p. NTIS, PC A23/MF A01.

The handbook, intended for use of utility project managers and project engineers, provides guidance in selection, installation, and operation of a limestone FGD system, covering all phases from inception of the project through design, procurement, operation, and maintenance of the system. It gives detailed accounts of utility experience with operational limestone scrubbing systems. It also deals extensively with optional process features and with recent innovative process modifications that enhance the efficiency of the system. Among the many available processes for desulfurization of flue gas from utility boilers, the limestone wet scrubbing process is widely used and is being enhanced by numerous technological advances.

40152 **(PB—82-110693) Study of automatic control system to maintain constant percentage SO_2 retention in a pressurized FBC. Final report sep 79-dec 80.** Daniel, K.J.; Finnigan, S.D.; Reinstrom, R.M. (General Electric Co., Schenectady, NY (USA)). Sep 1981. Contract EPA-68-02-3131. 174p. NTIS, PC A08/MF A01.

The report gives results of an assessment of the feasibility of using automatic controls to maintain a constant percentage SO2 removal in a pressurized fluidized-bed boiler (PFB) system as variations occur; e.g., in coal sulfur content or sorbent reactivity. The Clean Air Act amendments of 1977 indicate that future emission standards for SO2 should be based on a percentage reduction (comparing sulfur emissions with sulfur feed). In a PFB, sulfur feed (coal sulfur content, feed rate) and sulfur removal effectiveness (sorbent reactivity, feed rate) vary continually during operation. A transient model of a PFB plant has been developed, validated, and used to assess automatic control options. The preferred control option identified in the assessment would continuously monitor the sulfur content in the feed coal, and would adjust the sorbent feed rate to maintain a constant sorbent-calcium/coal-sulfur-feed ratio. Such a system would minimize, but not eliminate, the need for excess sorbent feed to ensure that the PFB did not exceed the specified percentage SO2 reduction on a 30-day average. The required techniques to continuously monitor coal sulfur content have not yet been commercially demonstrated.

40153 **Method for controlled burnout of abandoned coal mines and waste banks.** Chaiken, R.F. US Patent Application 209,173. 21 Nov 1980. 32p.

A method is provided for recovering energy from wasted coal.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 40117, 40202, 40368, 41355, 41368, 41396, 41397, 41457, 41459

40154 (LMF—91, pp 431-436) **Potential health and environmental effects of the fluidized bed combustion of coal.** Seiler, F.A.; Hobbs, C.H.; Cuddihy, R.G. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The potential health and environmental risks from fluidized bed combustion of coal are summarized. The largest impacts are likely to occur in the environment, resulting from acid deposition from the atmosphere. Transition from conventional combustion to fluidized bed combustion would substantially decrease acid deposition. Few human health effects can be projected for emissions of particles, trace elements, sulfur and nitrogen oxides. Risks of accidents and diseases involving industry workers and the public are significantly more important.

40155 **(PB—81-245045) Symposium proceedings: environmental aspects of fuel conversion technology, V (September 1980, St. Louis, MO). Report for February-August 1980.** Ayer, F.A.; Jones, N.S. (Research Triangle Inst., Research Triangle Park, NC (USA)). Jan 1981. 665p. NTIS, PC A99/MF A01.

From Environmental aspects of fuel conversion technology V; St. Louis, MO (USA) (Sep 1980).

The report documents presentations at the fifth EPA-sponsored symposium on the environmental aspects of fuel conversion technology, in St. Louis, MO, 9/16-19/80. The symposium served as a colloquium on environmental information related to coal gasification, indirect liquefaction, and direct liquefaction. The program included sessions on program approach, environmental assessment, and environmental control, including the development of EPA's pollution control guidance documents. Process developers and users, research scientists, and State and Federal officials participated in the symposium.

40156 **(PB—82-103573) Environmental assessment: source test and evaluation report - coal preparation plant no. 2. Final report Sep 79-Mar 81.** Buroff, J.; Strauss, J.; Jung, A.; McGilvray, L. (Versar, Inc., Springfield, VA (USA)). Apr 1981. Contract EPA-68-02-3136. 304p. NTIS, PC A14/MF A01.

The report gives results and conclusions of a source test and evaluation program at a coal preparation plant, representing cleaning plants that process run-of-mine coal with high pyritic sulfur content, use high technology coal cleaning processes, operate in a high-rainfall environment, and have a low soil-neutralization potential. The major objective of the program was to perform an environmental assessment on the plant's waste streams and fugitive emissions. Chemical analysis results indicated that all streams, except fugitive particulates, contained constituents which may have a potentially harmful health and/or ecological effect. For streams showing potential for ecological effects, Mn was of concern; for

streams showing a potentially harmful health effect, Mn and Cr were of prime concern. Contrary to previous studies, high NH3 concentrations were observed in the leachate. Further investigation of the NH3 source is warranted. Bioassays for fugitive particulates, sedimentation pond waters, and fine refuse slurry solid samples indicated moderate biological effects. For leachates, all health-related bioassays showed a low or nondetectable effect; however, the coal and coarse refuse leachate composite and the pond sediment composite produced a moderate effect on the ecological related algae test.

40157 **(PB—82-115312) Emissions and efficiency performance of industrial coal stoker fired boilers. Final report Aug 77-Nov 79.** Langsjoen, P.L.; Burlingame, J.O.; Gabrielson, J.E. (KVB, Inc., Minneapolis, MN (USA)). Jul 1981. 347p. NTIS, PC A15/MF A01.

The report gives results of field measurements of 18 coal stoker-fired boilers including spreader stokers, mass-fired overfeed stokers, and mass-fired underfeed stokers. The test variables included stoker design, heat release rate, excess air, coal analysis and sizing, overfire air, and flyash reinjection. Measurements included O_2, CO_2, CO, NO, NO_2, SO_2, SO_3, gaseous hydrocarbons, uncontrolled and controlled particulate mass loading, particle size distribution of the flyash, combustible content of ash, sulfur retention in the ash, and boiler efficiency. Particulate loading is shown to be largely dependent on stoker type and degree of flyash reinjection. It increases with heat release rate, but can be controlled with proper use of overfire air in many cases. Nitric oxide increases with excess air and grate heat release rate. These relationships are defined in the report. Overfire air, as it exists in current boiler designs, does not affect NOx. The report also addresses other relationships between operating variables and measured emissions and efficiency. A separate data supplement is available.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 40653

40158 **(DOE/ET/14693—T8) Peat resources of North Carolina. Quarterly progress report.** Ingram, R.L.; Otte, L.J. (North Carolina Univ., Chapel Hill (USA). Dept. of Geology). 1 Jul 1980. Contract AC01-79ET14693. 6p. NTIS, PC A02/MF A01. Order Number DE82007811.

Although the work on North Carolina peat deposits is far from complete, a preliminary estimate of the amount of peak was made. Table 1 has the listing of all three types of deposits, Pocosin, River Flood Plain and Carolina Bays, and their description such as area, weight, thickness and quality estimation. Work on the peats of Light Ground Pocosin has been completed and the final report will be distributed soon. Work is continuing on the three largest Pocosin deposits; East Dismal Swamp (Dare Peninsula), Dismal Swamp, and Croatan Forest. As for river deposits, reconnaissance work indicates that peat is to be found along the lower floodplains of the Chowan, Roanoke, and Cape Fear Rivers. The quality (ash content) is much more variable than for the pososin peats. There are approximately 2100 Carolina Bays deposits, over 800 ft long. A map is provided showing their distribution. Preliminary work shows that most of these bays contain good peat up to a maximum thickness of 15 ft.

40159 **(NP—2903923) Availability and feasibility of the recovery of Alabama lignite resources.** Simpson, T.A.; Anoma, E. (Alabama Univ., University (USA). School of Mines and Energy Development). Aug 1979. 68p. School of Mines and Energy Development, University of Alabama.

The Oak Hill member of the Naheola Formation in Southwest Alabama contains commercial lignite deposits of sufficient quantity and quality to support a surface mining operation. The site embracing Sumter, Marengo, and Wilcox counties, Alabama, chosen for a conceptual surface mine operation, is underlain by lignite reserves of about 282 million short tons. The deposits range in thickness from 1 to 14 feet and are under a cover of less than 250 feet. Their calorific value ranges from 4000 to 11,200 Btu per pound as mined: the ash content averages less than 16%. The moisture content on an as-received basis ranges from 45.5 to 53.0%. The mine was designed to use bucket wheel excavators and to produce about 2 million tons per year. At this rate of extraction, a mining life of 75 years was expected. An operational cost analysis shows that to meet present day mining costs, the lignite will have to be sold at $12.60 per ton. Therefore, the mine will have a low profitability rate. Mining problems will be severe and require a careful engineering design to contend with severe water problems from surface inundations and subsurface inflows. Groundwater conditions are recognized but hydrologic coefficients are unknown. Slope control problems will add significantly to the mining operations. Geotechnical data are lacking. Pre-mining plans for design and operational control will be an essential element in the environmental impact assessment, particularly in developing an adequate monitoring system.

40160 **(PB—81-205353) Seelyville coal: a major unexploited seam in Illinois. Illinois mineral note.** Treworgy, C.G. (Illinois State Geological Survey, Urbana (USA)). Mar 1981. 15p. NTIS, PC A02/MF A01.

New mapping at the Illinois State Geological Survey has revealed that a major minable coal seam, the Seelyville Coal Member of the Spoon Formation, underlies a large area of eastern Illinois. Although the Seelyville Coal has been actively mined in adjacent parts of Indiana for many years and its presence in Illinois known for some time, its extent in Illinois had not been determined. This study, which principally utilized geophysical logs from oil test holes, shows that the Seelyville Coal may be as much as 3 1/2 to 9 feet thick under an area of approximately 1,900 square miles of Clark, Clay, Crawford, Cumberland, Edgar, Effingham, Jasper, Lawrence, Richland, and Shelby Counties.

0120 Mining

REFER ALSO TO CITATION(S) 40198, 40202, 40653, 41244

40161 **(BMFT-FB-HA—81-002) Comparing report about research projects for cooling in mines sponsored by the HdA-program.** Reuther, E.U.; Dauber, C. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1981. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82901205.

Six research projects sponsored by the district and central governments are enganged in the different parts of cooling in coal mines, i.e. refrigeration, cooling medium transport and cooling of ventilation air. Refrigeration machines used for the mines are of a high technical standard and of a good operation reliability, but the best place of installation is a point of dispute. If more than two or three MW of cooling power are needed central refrigeration on the surface proves more adventageous, especially because of the better transfer of condenser heat. Whenever a narrow shaft keeps the diameter of the cooling medium pipe short, combined refrigeration on the surface and in the underground is useful. Transport of the cooling medium from the surface into the mine with two cooling medium cycles and with a high-pressure low-pressure heat exchanger stood the test in the local coal mines. Transport with only one cooling medium cycle and a pelton wheel has the advantage of lower investment, but further testing in the mine is still necessary. The heat exchange between ventilation air and cooling medium has also to be improved. With the present technique there is hardly any way to transfer a great cooling power into the ventilation air at the face line. Therefore cooling in the gateroads seems to be more effective.

40162 **(DOE/FE/00080—3) Longwall data bank 2. 2nd quarterly project status report, August 28-November 28, 1981.** (Bituminous Coal Research, Inc., Monroeville, PA (USA)). Mar 1982. Contract AC01-81FE00080. 11p. NTIS, PC A02/MF A01. Order Number DE82008200.

The literature search was completed during the period, except for an ongoing review of monthly abstract publications and coal mining journals. Working cards were completed for the comprehensive index file for all longwall publications of interest; abstracts were prepared for selected longwall publications. Revised questionnaire forms, with information from the original questionnaires, were forwarded for updating to nearly all companies pres-

ently in the questionnaire file. Selected operational data were tabulated and compared.

40163 **(PB—81-195687) An interactive computer system for evaluating coal mine illumination. Open file report (final) Oct 77-Nov 78.** (Mathematical Applications Group, Inc., Elmsford, NY (USA)). Dec 1978. 15p. NTIS, PC A02/MF A01.

A computer system for calculating the illumination on coal mine surfaces due to machine-mounted lights is described. Utilizing numerical models of mining machinery and measured data on luminaire output characteristics, the program computes the footcandle levels incident on the mine entry surfaces for any desired machine-luminaire-entry configuration, and shadowing effects of the machine are taken into account. Results are provided at 2-foot intervals on the face, left and right walls, floor, and roof. The system operates, interactively from a Tektronix 4014 graphics terminal which handles all input-output functions. The software is installed on a Cyber 74 computer that communicates with the terminal by a telephone line.

40164 **(PB—81-199010) Illinois mineral industry in 1978 and review of preliminary mineral production data for 1979. Illinois mineral notes (annual).** Samson, I. (Illinois State Geological Survey, Urbana (USA)). Feb 1981. 42p. NTIS, PC A03/MF A01.

The annual report of mineral production in Illinois in 1978 summarizes the output and value of minerals mined, and processed in Illinois, and of mineral products manufactured but not necessarily mined in Illinois. Detailed production summaries and analyses--including maps, tables, and graphs--are given for all mineral commodities.

40165 **(PB—82-107467) Coal technology programme meeting reports. coal winning: NCB mining research and development establishment, 8 november 1979. coal conversion: NCB coal research establishment, 16 april 1980.** (Science Research Council, London (UK)). Oct 1980. 25p. NTIS, PC A02/MF A01.

During 1978 the Engineering Board of SRC granted Specially Promoted Program status to the Coal Technology program. This recognized that coal would increase in importance as the cost of liquid and gaseous hydrocarbons rises with the decreasing availability of petroleum related sources. It was, therefore, considered necessary to anticipate and improve, through SRC supported research, the technologies required to win, transport, convert to liquid and gaseous fuels and utilize coal and coal based substances. In view of the interest in the program, and also in the hope of reaching a still wider audience the reports of the two meetings have been combined in this single booklet. The reports indicate specific problems of importance in coal winning and coal conversion but, naturally, do not cover all of the program priorities.

40166 **Dispersion tests and their application to problems of mine stability.** Seedsman, R.W.; Emerson, W.W. Mount Waverley, Victoria, Australia; Commonwealth Scientific and Industrial Research Organization (1981). 20p. (CSIRO—33). Commonwealth Scientific and Industrial Research Organization, PO Box 54, Mount Waverley, Victoria 3149, Australia.

Dispersion tests using wet remoulded material have been applied to a clayey siltstone to model its performance (loss of strength) during spoiling. The degree of dispersion is shown to depend on the amount of reworking of the original material, the water content at remoulding and the nature of the exchangeable cations. It is suggested that these simple dispersion tests can be used to model many mining procedures such as the break-up of the highwall and the construction of spoil piles and also the effect on stability of fresh water ingress. Not only will such tests pinpoint materials that will cause problems during mining but also may suggest ways of modifying mining operations to improve mine stability.

40167 **Production systems analysis in underground coal mines.** Douglas, W.J. (ed.). New York, NY; McGraw-Hill, Inc. (1980). 380p. (DOE/ET/12532—T8). Mining Informational Services, McGraw-Hill, Inc. 1221 Avenue of the Americas, New York, NY 10020 . Contract AM01-77ET12532.

The complexity of an underground mining system offers a wide range of interesting and challenging problems to the industrial engineer or mining systems analyst. This reference manual describes a variety of industrial engineering guidelines, analytical methods, modeling techniques, and performance measurement approaches for use in evaluating underground mining systems. Over the years, the art of industrial engineering has been lost, to a large extent, in our underground mines. The approach to solving productivity problems has been through the development and acquisition of new machines rather than through the application of sound engineering principles. Both approaches have merit, and are a part of the evolutionary process of improving our mining technology. This book is merely a beginning, a first step in summarizing the research efforts of a four-year period in a single volume. The research which provided basis for this manual has been sponsored by the US Department of Energy and Bureau of Mines, and by the many mining companies who participated in these projects, and for whom KETRON has provided professional and technical services. The chapters of this document are extracted from the reports, papers, and technical memoranda which have been completed in conjunction with these projects and research contracts.

40168 **(NASA-TM—76549) Effect of type of explosives and physical-mechanical properties of explosive rock on formation of toxic gases in atmosphere of shafts.** Mindeli, E.O.; Khudyakov, M.Y. Translated from *Vzryvnoye Delo (USSR);* No. 72, 147-150(1973). 8p. NTIS PC A02/MF A01.

The quality of toxic gases formed during explosive work in underground shafts depends upon the type of explosives and the conditions of explosion. Several types of explosives and rocks were examined. All remaining conditions were maintained the same (sandy-argillaceous stemming, electrical method of explosions, diameter of blast holes, and the direct triggering of charges).

0130 Transport And Handling

REFER ALSO TO CITATION(S) 40101, 40130

40169 **(AD-A—103740/7) The effects of ice on coal movement via the inland waterways. Special report.** Lunardini, V.J. Jr; Minsk, L.D.; Phetteplace, G.E. (Cold Regions Research and Engineering Lab., Hanover, NH (USA)). Jun 1981. Contract DE-A101-80ET14356. 80p. NTIS, PC A05/MF A01.

The Inland Waterways now carry about 11% of the coal production of the United States. Significant increases in the production, use, and transportation of coal have been projected. The ability of the Inland Waterways to increase its coal handling capacity, especially during the winter has been questioned. That part of the Inland Waterways which carries significant coal and which may experience significant ice problems includes the following rivers or waterways: Ohio, Monongahela, Allegheny, Kanawha, Upper Mississippi, and Illinois. Coal transportation along these rivers may be locally interrupted for periods up to 30 days or more every three to five years. Coal handling facilities, navigation channels, and lock and dam sites along the ice prone rivers were surveyed by visit or telephone to ascertain the scope of the ice problems. Coal moves through any part of the waterways system as a series flow from the coal loading/unloading facilities, along the navigation channels and through the locks to its destination. The importance of ice as a barrier to increased coal movement on the waterways studied manifests itself differently for each link of the flow system. In order of importance the ice will affect the navigation channels, locks and dams, and finally the coal loading/unloading facilities. The coal handling facilities will not be significantly slowed down by ice problems associated with winter navigation. Only rarely is a coal handling facility stopped by ice when the locks and dams or navigation channels are operating normally. The major exception may

be the rail car to barge loading link which can cause slowdowns due to coal freezing in the rail cars.

40170 **(AD-A—104132/6) Coal handling. Final report.** Rhodes, J.L. (Army Facilities Engineering Support Agency, Fort Belvoir, VA (USA). Technology Support Div.). 1 Apr 1981. 43p. NTIS, PC A03/MF A01.

This report contains information on coal handling discussed under the following headings: coal selection; transportation; unloading coal; feeders; coal storage; crushing; sampling; conveying; and coal handling support operations and equipment.

40171 **(DOE/FE/05147—T3) Literature review and binder and coal selection for research studies on coal agglomeration.** Nelson, S.G.; Kuby, O.A.; Girimont, J.A.; peterson, C.A.; Saller, E. (McKee (Davy) Corp., Cleveland, OH (USA)). 26 Feb 1982. Contract AC01-81FE05147. 87p. NTIS, PC A05/MF A01. Order Number DE82011040.

This report discusses the results of a literature survey on coal agglomeration and the approaches that were employed in selecting binders and coals to be studied in a process development program currently being performed for the Department of Energy. The survey is the first step toward the development of a useful process for the agglomeration of coal fines for use in a fixed-bed gasifier. Literature was found and reviewed on the effects of coal composition and physical properties, on agglomeration techniques and operating variables, on binders or additives to promote agglomeration, on pretreatment techniques on agglomerate feedstocks and post-treatment techniques on formed agglomerates, and on test results obtained by researchers in the past using various additives, treatments and agglomeration techniques. Much of this information did not deal directly with agglomerates for fixed-bed gasifiers, but the reported observations and results could be extrapolated to give useful guidelines for research plans. Conclusions and plans for further work are presented.

40172 **(DOE/PC/42268—T2) Ultrasonically enhanced size reduction of coal. Quarterly technical progress report no. 2, September 26, 1981-December 25, 1981.** Tarpley, W.B. Jr.; Stephey, H.M.; Taylor, S.R. (Energy and Minerals Research Co., Exton, PA (USA)). Jan 1982. Contract AC22-81PC42268. 12p. NTIS, PC A02/MF A01. Order Number DE82008679.

Increasing needs for pulverized coal necessitate more efficient grinding technologies, which, with the exception of chemical comminution, have not significantly advanced in the last 50 years. Energy inefficiencies, equipment wear and maintenance are significant cost factors. Another wasteful characteristic is the broad size range of resulting particles. In addition to the unnecessary cost of production, too many fines often make for difficulties in processing and flowability; for other applications, even a few coarse particles can plug orifices, valves, nozzles, etc. Therefore, it is desirable to have relatively narrow size distributions, both from the standpoint of production costs and for end use applications. Our preliminary work in ultrasonic grinding of coal over a broad range of feed stock and final product has been very promising. The beneficial effects of an ultrasonic assist to the grinding procedure include: rapid cyclic promotion of fatigue crack growth (10,000 to 50,000 cycles per second); preferential delivery of energy to discontinuities; reduction of particulate shielding by deagglomeration; promotion of stress corrosion cracking with grinding aids (as in moist grinding); cavitation grinding in a moist environment; and preferential shear. This work is expected to demonstrate the beneficial effects of ultrasonic coal comminution on a controlled laboratory scale, to evaluate grinding selectivity, and to obtain a preliminary estimate of the power required. The experimental work is expected to show that: energy efficiency can be improved; abrasive wear on the system will be reduced; preferential fracture will reduce product size extremes; and selective fracture may allow harder inclusions (ash and pyrites) to remain unaltered for easing screening.

40173 **(PB—81-142127) Water quality aspects of coal transportation by slurry pipeline. Project completion report.** Moore, J.W. (Arkansas Univ., Fayetteville (USA). Water Resources Research Center). Aug 1980. 328p. NTIS, PC A15/MF A01.

The research program was designed to: (1) identify and characterize water quality changes during movement of western coal by slurry pipeline; (2) determine feasibility for using impaired quality water (such as municipal industrial effluents) as slurry medium; and (3) determine treatment measures for restoring water quality of the slurry waste water if needed. Water quality parameters measured included alkalinity, BOD, COD, trace elements, dissolved solids, nitrate, sulfate, pH, silica, specific conductance, and total hardness.

40174 **(PB—81-187221) Water pollution potential of coal-slurry pipelines. Final report, June 1977-December 1980.** Peavy, H.S.; Jennings, P.W.; Murgel, G.A. (Montana State Univ., Bozeman (USA)). Apr 1981. 78p. NTIS PC A05/MF A01.

This report characterizes those contaminants associated with transport waters from coal-slurry pipelines. This was accomplished through tests using a rotating bench scale reactor. Tests consisted of coal mixed with (1) tap water, (2) tap water with additives, (3) synthetic saline water, and (4) synthetic saline water with additives. Tests were performed for a period of 12 days each. The results of the research will be useful to pipeline planners and regulatory agencies as a preliminary tool to assist them with decisions regarding slurry water quality, water reuse possibilities, and treatment and utilization options for spent slurry liquids.

40175 **(PB—81-247520) Use of coal cleaning for compliance with SO2 emission regulations. Final report June 1977-June 1981.** Hall, E.H.; Lemmon, A.W. Jr.; Robinson, G.L.; Goodman, F.K.; McCreery, J.H. (Battelle Columbus Labs., OH (USA)). Sep 1981. 438p. NTIS, PC A19/MF A01.

The report gives results of an evaluation of coal cleaning as a means of controlling SO2 emissions from coal-fired stationary sources. Coal cleaning was examined in the light of various existing and proposed SO2 emissions regulations to determine applications in which the technology would be most useful. Barriers were identified that prevent wider application of coal cleaning. Actions are described which should be taken to overcome these barriers. Much information about coal is compiled as resource data on the coal reserve base, present and projected coal production, coal cleanability, current and projected coal use by utilities and industry, size and age distribution of coal-fired facilities, and the nature of coal contracts. Environmental impacts of coal cleaning are compared with those of other sulfur removal strategies such as flue gas desulfurization and the use of low-sulfur coal. Similarly, costs of the various SO2 control alternatives are compared. Cost analyses show an economic superiority for physical coal cleaning generally, even if supplemental application of another method, FGD, must be used to achieve full compliance with NSPS or SIP emission limits.

40176 **(PB—82-136409) Implications of power plant coal conversions on the ports of New England: Volume I. Final report.** Osleeb, J.P.; Ratick, S.J. (Boston Univ., MA (USA)). Oct 1981. 65p. NTIS, PC A04/MF A01.

This document presents the results of a systematic study of the transportation of coal into the New England region. This coal movement is to satisfy the anticipated energy demands of the electric utilities in the regions which have been ordered to convert to coal under the 1978 Fuel Use Act. Historically, waterborne movements of coal into the New England region were very important. The results of this analysis indicate that waterborne movements of coal can once again predominate. Even with the added investments necessary for the construction of new coal handling equipment at the ports of New England and the costs associated with additional coal transfers, water modes tend to be the most economical.

40177 **(PB—82-136417) Implications of power plant coal conversions on the ports of New England. Volume II: appendices.** Osleeb, J.P.; Ratick, S.J. (Boston Univ., MA (USA)). Oct 1981. 206p. NTIS, PC A10/MF A01.

Mandated electric generation coal conversions in New England could place a severe strain on the coal handling and transportation facilities in New England ports. This paper presents an analytical scheme leading to the development of optimal plans for the reuse and redevelopment of marine transport networks in New

England. Utilizing a port inventory that provides information on existing coal handling facilities and the capability of the ports to increase capacity, a mathematical programming model is used to determine the optimal capacity, placement, and railroad and marine interface of coal handling facilities within and between the New England ports and converting power plants.

40178 **Desulphurization of coal for power stations.** Holz, H.; Monostory, F.P. Berlin, Germany, F.R.; Umweltbundesamt (1979). 118p. (In German).

This paper describes tests of different methods to reduce the pyrite content of coal, including grinding of run-of-mine fine coal and middlings for better separation, cleaning of coarse slurry by vibrators and slurry cleaning by froth flotation. It also describes test of equipment and machines to examine these methods. The efficiency and effectiveness of different methods for particular coal properties were evaluated. Sulphur content in the concentrate was reduced to below 1%. (23 refs). (In German)

0140 Combustion

REFER ALSO TO CITATION(S) 40134, 40249, 40689, 40700, 41100, 41281

40179 (CONF-811061—, pp II.42-II.50) **Corrosion of FBC heat-exchanger materials.** Natesan, K. (Argonne National Lab., IL). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

An understanding of deposit-induced corrosion behavior of heat-exchanger and gas turbine materials exposed to multicomponent gas environments is essential for materials selection in advanced energy systems that utilize fossil fuels. For this purpose, characterization of environments in direct combustion processes and evaluation of materials exposed to complex gas mixtures that simulate normal operating conditions and off-normal excursion situations are needed. In the case of fluidized-bed combustion systems, the presence of sulfated limestone and low oxygen partial pressures leads to deposits of $CaSO_4$. The presence of locally reducing oxygen partial pressures in the vicinity of the deposit can lead to sulfidation/oxidation of the heat-exchanger tube surface. The present program will establish the corrosion rates and mechanism for corrosion of selected materials as a function of gas chemistry, temperature, heat flux, and type and sequence of deposit.

40180 (CONF-811061—, pp V.1-V.11) **Corrosion within coal fired fluidized bed combustion systems.** Minchener, A.J. (National Coal Board, Cheltenham, England). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Corrosion tests of the CRE fluidized-bed combustion pilot plant are reported. In another experiment it was found that circumferential temperature variations around a tube increase as the temperature difference between the tube and the bed increase. Oxygen concentrations within the bed were measured by an electrochemical probe. (LTN)

40181 (CONF-811061—, pp V.17-V.25) **Heat exchanger materials for fluidized-bed coal combustion.** Devan, J.H.; Godfrey, T.G.; Ficalora, P.J. (Oak Ridge National Lab., TN). 1981. NTIS, PC A24/MF A01. Contract W-7405-ENG-26.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

In order to determine if solid-state reactions involving sulfates are playing a significant role in the corrosion of AFBC heat exchanger tubes, a differential thermal analysis (DTA) and an x-ray diffraction study were initiated. The DTA-TGA and x-ray diffraction study of the reactions of Fe, Cr, Co, Ni, 304 stainless steel, 2 1/4 Cr-1 Mo, 9 Cr-1 Mo steels or alloy 800 with $CaSO_4$ and Ni or Co with their respective sulfates have been completed. A Mettler thermoanalyzer with combined DTA-TGA capability has been used. We have found that solid state reactions do occur between $CaSO_4$ and the alloy constituents of candidate AFBC heat exchanger materials. These reactions occur below the normal range of AFBC bed operating temperatures. Chromium is the only element studied that did not form sulfides on reaction with $CaSO_4$. The products of reaction in the case of nickel, cobalt, and iron are sulfides, oxides, and CaO. In the case of iron an unidentified phase, which can be prepared by reactions of CaO and FeS, is also observed.

40182 (CONF-811061—, pp V.26-V.36) **Protective coatings or claddings for turbines for use with pressurized fluidized-bed combustors (PFBC).** McCarron, R.L.; Brobst, R.P.; Spriggs, D.R. (General Electric Co., Schenectady, NY). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The objectives of the simulation tests are to (1) evaluate the effects of changes in key PFBC variables (gas/particle velocity, particulate loading and size distribution, temperature, and alkali contaminant level) on the erosion/corrosion behavior of several state of the art gas turbine base alloys, coatings and claddings and (2) evaluate the erosion/corrosion resistance of advanced coatings and claddings in a simulated PFBC environment for times up to 1000 hours. To date six 250 hour simulation tests have been run to evaluate the effects of changes in key PFBC variables. A summary of the operating conditions and effects investigated in each of the six 250 hour tests is given. The six alloy systems consistently exhibited the same relative performance throughout the six tests: platinum-aluminided IN-738 most resistant to degradation followed in order by CoCrAlY-clad IN-738, FrCrAlY-clad IN-738 unprotected IN-738, Inconel 671-clad IN-738, and FSX-414, and this ranking compares favorably with that observed in the Exxon test. The primary type of corrosion attack, i.e., oxidation or sulfidation, exhibited by each alloy remained essentially unchanged throughout the six simulation tests independent of the addition or omission of an alkali sulfate flux to the hot gas stream.

40183 **(DOE/PC/30294—5) Pulverized fuel combustion: modeling and scaleup methodologies. Fifth quarterly report, October 1, 1981-December 31, 1981.** Lewis, P.F.; Kemp, N.H. (Physical Sciences, Inc., Woburn, MA (USA)). Feb 1982. Contract AC22-80PC30294. 13p. (PSI-TR—313). NTIS, PC A02/MF A01. Order Number DE82008183.

During the past quarter we have devoted most of our effort toward developing and formulating the quasi-one-dimensional fluid flow and mixing model. There has been some effort expended toward improving the gas phase and heterogeneous chemistry models; however, we prefer to hold reporting on that progress until the next quarter when that work will be complete. We have also been evaluating two flux models of radiative transfer for use in the combustor model; again, this work should be complete in the next quarter. This report will deal only with the fluid flow/mixing model development.

40184 **(DOE/PC/40268—T1) Investigation of pyrite as a contributor to slagging in Eastern bituminous coals. Quarterly progress report, October 1, 1981-February 28, 1982.** (Foster Wheeler Corp., Livingston, NJ (USA)). Mar 1982. Contract AC22-81PC40268. 24p. NTIS, PC A02/MF A01. Order Number DE82008569.

Slagging by bituminous eastern US coals in industrial furnaces results primarily from pyritic iron in the coal ash. Since it has been learned that coals of similar pyritic levels fired in furnaces of similar design do not always produce the same slagging conditions, and since segregation of pyrites from other minerals does occur when slagging is encountered, slagging must be attributed to the size and orientation of the pyrites in the coal, in addition to their concentration level. A program is underway to examine slags from coals with varying concentration levels, size distribution, and orientation of pyrite with other mineral matter, when the coals are fired in a laboratory furnace under controlled conditions simulating an industrial furnace. During Task 1 Foster Wheeler will select eight candidate coals with variations in pyrite size and distribution according to the specifications of the Research Plan. The selection will be made after reviewing the specification with such agencies as the DOE Fuel Preparation Laboratory at Bruceton, Pennsylvania; the Pennsylvania State College of Mineralogy and Coal Combustion Laboratory; the Coal Research Department of the University of Kentucky; the Indiana State Geological Survey; and the Illinois

Geological Survey. Foster Wheeler will locate the source of each coal, negotiate the coal purchase, and arrange for shipment of the required amount of each coal selected. The coals will be selected to provide a suitable matrix of pyrite size distribution and concentration, permitting identification of the source of pyrite responsible for slagging.

40185 **(PB—81-186942) Environmental perspective on the emerging oil shale industry.** (Environmental Protection Agency, Cincinnati, OH (USA). Industrial Environmental Research Lab.). Dec 1980. 348p. (EPA—600/2-80-205A). NTIS PC A15/MF A01.

The report conveys EPA's understanding and perspective of oil shale development by providing (a) a summation of available information on oil shale resources, (b) a summary of major air, water, solid waste, health, and other environmental impacts, (c) a brief overview of applicable pollution control technology, (d) suggestions for the sampling, analysis, and monitoring of emissions, effluents, and solid wastes from oil shale processes, and (e) suggestions for interim objectives for emissions, effluents, and solid waste control. The report provides a brief summary discussion of the environmental problems of oil shale development. For the reader not acquainted with oil shale technology, it also provides a summation of the major retorting methods and their probable emissions, effluents, and solid wastes.

40186 **(PB—81-190969) Monitoring strategies for fluidized bed combustion coal plants. Final report.** Garlauskas, A.B.; Hina, C.E.; Blair, T.T.; Kangas, M.J.; Cornett, C.L. (Dalton-Dalton-Newport, Cleveland, OH (USA)). Mar 1981. 316p. NTIS PC A14/MF A01.

Air and water monitoring strategies for commercial-size Fluidized Bed Combustion (FBC) coal plants are presented. This is one of five reports developing air and water monitoring strategies for advanced coal combustion (FBC), coal conversion (coal gasification and liquefaction), and oil shale conversion commercial-scale plants. The objective of the five-part project is to assure that, when any of the coal or oil shale technologies become commercialized, appropriate and cost-effective monitoring requirements are in effect to protect the public health and the environment without delaying commercialization. In this report, air quality monitoring strategies are presented for compliance audits, and for monitoring fugitive emissions. Water quality monitoring strategies are presented for leachates from fly ash and other solid wastes and from coal and sorbent material storage piles, and for pollutants generated by cooling towers, ponds, or canals.

40187 **(PB—82-102328) Feasibility of burning coal in catalytic combustors. Final report May-Nov 78.** Goldberg, P.M.; Chu, E.K.; Kelly, J.T. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). 1981. Contract EPA-68-02-2611. 93p. NTIS, PC A05/MF A01.

The report gives results of a study, showing that pulverized coal can be burned in a catalytic combustor. Pulverized coal combustion in catalytic beds is markedly different from gaseous fuel combustion. Gas combustion gives uniform bed temperatures and reaction rates over the entire bed length; however, depending on flow conditions and bed geometry, little combustion may occur downstream of the bed. For the bed configurations, fuel supplies, and test conditions studied, pulverized coal combustion results in significant temperature and reaction gradients over the bed length and substantial combustion downstream of the bed. Thus, for pulverized coal combustion, the bed acts mainly as a combustion initiator and stabilizer. A significant portion of the combustion process, primarily that associated with char burnout, occurs downstream of the bed.

40188 **An overview of fluidized-bed combustion /FBC/ design practice.** Shang, J.Y.; Notestein, J.E.; Mei, J.S. (U.S. Department of Energy, Morgantown Energy Technology Center, Morgantown, WV). pp 2184-2191 of Proceedings of 16th intersociety energy conversion engineering conference, Atlanta, GA, August 9-14, 1981. Volume 3. New York, NY; American Society of Mechanical Engineers (1981).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

A short history of fluidized bed coal combustion is provided, noting that addition of a limestone bed contributes to sulfur retention, and comparisons are made with stoker and pulverized bed boilers. Advantages to fluidized bed combustion (FBC) are given as the thermal inertia of the limestone bed, inherent vigorous mixing for turbulent, efficient combustion, and larger particle size than in a catalytic cracker. Major components of an FBC are described, including windbox, distributor, feeder system, combustion chamber, bed material drainage, and primary dust recovery system. Fundamental differences between FBC and conventional boiler technology are stressed and design considerations for an FBC are listed with explanations. Recirculation of fly ash is shown to be effective only with an in-combustor vortex, which returns the ash to the flame before it has time to cool. Finally, ongoing experiments to determine the relative usefulness of burning various alternate fuels such as shales, lignite, and shredded tires in an FBC are reported.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 40700

40189 **(ECE/COAL—57) Coal situation in the ECE region in 1979 and its prospects.** (United Nations, New York (USA)). 1981. 79p. United Nations, New York, NY.

The study is in two parts. In part I, the coal market is analyzed in general terms and attention is drawn to the trends and problems common to all countries of the region. Part II is devoted to country monographs.

40190 **(EPRI-EA—2255-Vol.1) Review of computational aspects of planning models. Volume 1. CRA/EPRI coal market analysis system. Final report.** Bradley, G.H.; Brown, G.G.; Graves, G.W. (Optimal Decisions, Carmel, CA (USA)). Feb 1982. 48p. NTIS, PC A03/MF A01. Order Number DE82902102.

This report presents the results of a review of the computational aspects of the CRA/EPRI Coal Market Analysis System developed by Charles River Associates. The computational analysis focuses on validation of the computer model, ease of solution by the user, and reduction of solution costs by use of alternative computational procedures. The analysis shows that the computer model faithfully implements the Coal Market Analysis System and that the computational procedures produce the results described in the model documentation. Analysis of the computational structure and solution of the model by two independent solution procedures confirms the experience by Charles River Associates that the model is easily solved without assistance from either a computer programmer or an optimization expert. The embedded optimization problems are badly scaled numerically; it is recommended that this be corrected to allow easier movement of the model to a different computer. Automatic analysis of the embedded linear programming problems shows that significant computational savings could be realized by exploiting special structure that is present in the model. The model is shown to be a network with gains that can be solved by specialized computer packages. The problems are also shown to have significant generalized upper bound structure that can also be exploited using specialized computer packages. A slight reformulation of the model is shown to yield an equivalent model that is significantly less costly to solve. The reformulated model is a transportation flow problem that can be solved by very efficient computer packages that reduce the cost of solving the linear program by a factor of at least 25. In addition to reducing the solution costs by a significant factor, the reformulated model is easier to run and can be moved more easily to different computers.

40191 **(EPRI-EA—2255-Vol.2) Review of computational aspects of planning models. Volume 2. RAm utility financial forecasting model. Final report.** Bradley, G.H.; Brown, G.G.; Graves, G.W. (Optimal Decisions, Carmel, CA (USA)). Feb 1982. 33p. NTIS, PC A03/MF A01. Order Number DE82901860.

The report presents the results of a review of the computational aspects of the Regulatory Analysis Financial Model developed by Temple, Barker and Sloane, Inc. The computational analysis is focused on the user interface to the model, computer charges, and time spent by the user of the model. The design of the Regulatory Analysis Financial Model computer program is such that the

user must be a sophisticated computer time-sharing user in order to run the model. Given the requirement of a sophisticated user, the human interfaces are good; the single exception is the error messages. The use of the model is discussed and charges for computer time, connect time, and file storage are detailed. Suggestions to reduce these charges are presented. Two proposals to significantly reduce computer charges and the time spent by the user are presented. The first involves a minor redesign of the computer program to reduce file storage charges. The second proposal is a more significant redesign of the computer program that reduces charges and also reduces the time for the user to conduct the analysis. It is estimated that computer charges would be reduced by 40% to 50% and that computer connect charges and user time would be reduced by more than 50%.

0160 Health And Safety

REFER ALSO TO CITATION(S) 40154, 40161, 40168, 40318, 41546, 41655, 41658, 41659, 41660, 41664, 41670

40192 (LMF—91, pp 381-384) **Summary of mutagenic and cytotoxic properties of fluidized bed combustion and pulverized coal combustion fly ash.** Clark, C.R.; Hobbs, C.H.; Carpenter, R.L.; Hanson, R.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Fly ash samples were collected from cleanup devices and just prior to exit from the stack in the effluent stream from both pulverized coal combustors (PCC) and fluidized bed coal (FBC) combustors during the combustion of a variety of coals under different operating conditions. The materials were studied for cytotoxicity in canine alveolar macrophages and for mutagenicity in the Salmonella (Ames) bioassay. Compared to a respirable quartz particle standard (DQ12), none of the fly ash samples tested were cytotoxic to macrophages at concentrations up to 100 $\mu g/10^6$ cells (100 μg/ml), although phagocytosis of the particles was demonstrated. The n-pentane extracts of Tenax adsorbent were not mutagenic, which suggests that there is no mutagenic activity in the vapor-phase organics. These comprise up to 95% of the FBC organic emissions that are gas chromatographable. Dichloromethane extracts of FBC and PCC fly ash, however, were often mutagenic. The mutagenic activity of the ash in the process stream generally increased with (1) increasing distance from the combustor bed, (2) increasing combustor temperature and (3) decreasing particle size. Data from comparative studies show that FBC fly ash is no more cytotoxic or mutagenic than ash from PCC.

40193 (LMF—91, pp 385-387) **Comparison between the mutagenic responses of bacteria and mammalian cells to a coal-combustion fly ash extract.** Li, A.P.; Clark, C.R.; Hanson, R.L.; Henderson, T.R.; Hobbs, C.H. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The mutagenicity of a coal-combustion fly ash extract was tested in bacteria (Salmonella typhimurium) and cultured mammalian (Chinese hamster ovary (CHO)) cells. Direct-acting mutagenicity was observed in bacteria, with the mutagenicity decreased by Aroclor-1254-induced rat liver supernatant (S-9). The opposite was observed in mammalian cells. Mutagenicity of the extract at the hypoxanthine-guanine phosphoribosyl transferase (HGPRT) gene locus was observed only in the presence of S-9. Our results suggest that the chemicals responsible for bacterial mutagenicity in the fly ash extract were different from those responsible for mammalian mutagenicity.

40194 (LMF—91, pp 393-398) **Inhalation toxicity of fly ash effects of a four-week exposure of rats.** Hobbs, C.H.; Carpenter, R.L.; Bice, D.E.; Mauderly, J.L.; Pickrell, J.A.; Silbaugh, S.A.; Hahn, F.F.; Henderson, R.F.; Wolff, R.K. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Fischer-344 rats were exposed 5 days per week, 7 hours per day for four weeks to aerosols of fly ash collected from a pulverized coal combustion power plant. the concentration of fly ash in the exposure chamber was 37 mg/m^3 with a mass median aerodynamic diameter of 2.7 μm. Animals were sacrificed at 2, 4, 6, 26 and 42 weeks after start of the exposure, and functional, biochemical, immunological and morphological endpoints were evaluated. At the end of exposure, about 2 mg of fly ash was present in the lungs of the animals. There was no significant difference between fly ash-exposed and control animals in the respiratory function values examined after exposure. Tracheal mucous clearance in exposed animals was unchanged from controls, but deep lung clearance of a second aerosol ($^{67}Ga_2O_3$) was significantly longer in the exposed animals. Only minimal changes were observed in a number of pulmonary biochemical parameters measured. On histopathological examination and in immunological studies, increased size of lung-associated lymphoid tissue and lymph nodes of the exposed animals were observed. The fly ash used in this study has a relatively low inhalation toxicity based on the parameters measured.

40195 (LMF—91, pp 441-448) **Summary of physicochemical characteristics of process streams of an experimental low Btu coal gasifier.** Newton, G.J.; Carpenter, R.L.; Hanson, R.L.; Benson, J.M.; Henderson, R.F.; Hobbs, C.H. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Results of physicochemical characterization of process streams at the Morgantown Energy Technology Center's stirred-bed, Lurgi type, low Btu coal gasifier are summarized. Data came from one sampling effort conducted in September 1980 and another in June 1981. Gaseous, liquid and solid process and waste streams were analyzed for physical and chemical characteristics relevant to assessment of inhalation hazards associated with this energy technology.

40196 **(PB—81-196735) Direct method determination of the gas content of coal: procedures and results. Bureau of investigations/1981.** Diamond, W.P.; Levine, J.R. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Mar 1981. 42p. NTIS, PC A03/MF A01.

The explosion hazard of methane-air mixtures has become an increasingly serious mine planning problem, and an advance assessment of methane gas potential can therefore be essential for a safe and economic mine development program. As part of its coal mine health and safety program, the Bureau of Mines has developed a simple, inexpensive test to measure the methane content of coal samples obtained from exploration cores. The gas content of coal per unit weight as determined by the direct method test can be used as a basis for a preliminary estimate of mine ventilation requirements, and to determine if degasification of the coalbed in advance of mining should be considered.

40197 **(PB—81-211856) Digging our own graves: coal miners and the struggle over black lung disease. Doctoral thesis (final).** Smith, B.E. (Brandeis Univ., Waltham, MA (USA). Dept. of Sociology). May 1981. 649p. NTIS, PC A99/MF A01.

The report analyzes the controversy over black lung disease among U.S. coal miners, situated within the recent struggle over industrial relations in bituminous coal. Summaries of the postwar coal industry and the changing medical approach to black lung provide the historical backdrop to the recent controversy. The development of the black lung movement is reconstructed primarily through material from oral interviews with its participants. The movement is viewed essentially as a class conflict between miners and operators over who would bear the burden of occupational disease: miners, by continuing to be disabled and without compensation; or the operators, by reducing dust levels in the mines and financing benefits for disabled workers.

40198 **(PB—81-236762) Study of respirable dust outby the working face of a coal mine. Open file report (final) 30 June 1976-16 October 1978.** Rankin, R.L.; Rodgers, S.J. (MSA Research Corp., Evans City, PA (USA); Bureau of Mines, Washington, DC (USA)). 31 Mar 1980. 181p. NTIS, PC A09/MF A01.

The objective of this investigation was to conduct surveys of respirable dust concentrations in coal mining operations at locations outby the working face. The results of these surveys were directed toward (1) identifying outby dust sources, (2) evaluating the severity of the major dust sources, (3) establishing dust sampling frequency, (4) establishing dust sampler locations, and (5) assessing the areas of influence of the dust sources. The study included dust sampling of only nonhigh-risk personnel and areas at six different mines. Thirteen continuous mining, four longwall, and two conventional mining sections were sampled. The severity of outby respirable dust sources such as load points, runways, dump points, beltways, transfer points, and main haulage operations were characterized and areas within the mine ranked according to severity. Information on engineering controls was also acquired. Guidelines for implementing a dust sampling program are presented and include sampler locations, ventilation surveys, dust surveys, effects of shift-to-shift variations, and sampling frequency.

40199 **(PB—81-242877) Occupational hazard assessment: coal liquefaction. Volume I - summary.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Mar 1981. 30p. NTIS, PC A03/MF A01.

The coal liquefaction process converts coal into hydrocarbon products. In doing so, it both uses and produces toxicants potentially hazardous to worker health. The toxicants are varied, ranging from simple chemicals to complex mixtures or organic carcinogens. The possible health effects are also varied. Animal studies have demonstrated that some of the process chemicals have produced tumors at the site of application. Some workers may be exposed by inhalation of gases, vapors, or airborne particles, skin contact with airborne material, contact with contaminated surfaces, or accidental ingestion. Some of these same chemicals have caused severe long-term effects such as skin and lung cancer in workers in similar industries. Other potential adverse health effects may include fatal poisoning from inhalation, severe respiratory irritation, and chemical burns. Fires and explosions can also occur. This document is designed to provide information that can be used to guard against these potential adverse health effects. Measures such as engineering controls, specific work practices, personal protective equipment, medical surveillance and exposure monitoring, record-keeping, and emergency plans and procedures are recommended.

40200 **(PB—81-242885) Occupational hazard assessment: coal liquefaction. Volume II - assessment.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Mar 1981. 82p. NTIS, PC A05/MF A01.

This document reviews and evaluates potential occupational hazards to workers in coal liquefaction pilot plants. By addressing the hazard while direct coal liquefaction technology is still being developed, the risk of potentially adverse health effects can be substantially reduced. In this document recommendations are made for reducing the risks of these adverse health effects. Failure to take adequate precautionary measures may result in needless risks to worker health and safety. Coal liquefaction is the conversion of coal to liquid hydrocarbon products. The major products of most coal liquefaction processes are condensed aromatic liquids; however, some gases and solids are also produced, depending on the type of coal, the process, and the operating conditions used.

40201 **(PB—82-109836) Health implications of coal related energy development: mining impacts. Final report 1 Jan 78-30 Apr 80.** Zanetos, M.A.; Savitz, D.A.; Warling, J.C.; Sachs, N. (Battelle Columbus Labs., OH (USA)). Sep 1981. 278p. NTIS, PC A13/MF A01.

The purpose of this project was to establish a method for prospective epidemiological analysis of the health effects associated with the development of western coal sites. Particular emphasis was placed on potential community health effects related to mining, especially mining effluents which may enter drinking water supplies in hazardous quantities. The study area is defined as United States EPA Region VIII which includes Colorado, Utah, Montana, Wyoming, and the Dakotas. This research effort involved: (1) development of criteria for selecting communities suitable for future in-depth study and selection of several such communities; (2) characterization of health and environmental quality in the region as a whole; (3) formulation of data requirements for a prospective epidemiological study; and (4) evaluation of the quality of environmental, health, and demographic data currently available for such a study in these communities.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 40175, 40895

40202 **(NP—2903961) Report of effects of land-reclamation policies on the economic feasibility of lignite surface-mine development.** Bird, R.; Misiolek, W. (Alabama Univ., University (USA). School of Mines and Energy Development). 1979. 74p. School of Mines and Energy Development, University of Alabama, University, AL.

Top-soil replacement is the focus of attention in surface mine reclamation policy discussions. In Alabama and many other states topsoil reclamation is not required presently, but such requirements are under consideration. It seems clear that topsoil reclamation policy will critically affect the profitability and economic feasibility of lignite mining in south Alabama. The economic feasibility of lignite surface mining in south Alabama will depend on the estimated cost of mining in comparison to the price per ton which a potential user would be willing to offer. Based on limited data concerning recent transactions, low sulfur lignite is presently being sold in North Dakota and Texas for approximately $.50 per million Btu's. Based on 6500-8000 Btu's per pound, this is equivalent to $6.50 to $8.00 per ton. Some recent long term contracts in excess of $8.00 per ton have been reported for the relatively high Btu, low sulfur lignite in North Dakota. The extent to which processing is included in these prices is unknown. Sulfur content has a significant impact on coal prices. The sulfur content of Texas lignite averages 1%. Since the price range for Texas lignite is $6.50 to $8.00 per ton, a rough adjustment for sulfur content would imply a price of $4.55 to $5.60 per ton for Alabama lignite. These prices are significantly less than the mining costs estimated under even the most favorable possible conditions. If it is necessary to deduct user processing costs from the effective price, then the outlook for commercial mining of Alabama lignite is even less favorable. Even without a topsoil reclamation requirement, the present economic factors are contraindicative for lignite mining now. If lignite mining is to become economically feasible in the future, it will be necessary for the potential price of Alabama lignite to rise significantly relative to the mining costs.

40203 **(PB—81-188484) Patterns and trends in Federal coal lease ownership 1950-80; a technical memorandum.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Mar 1981. 78p. NTIS PC A05/MF A01.

This memorandum traces the history of the 538 Federal coal leases in existence at the end of 1979. It focuses on the coal lessees themselves: who they are, what they do, how and when they acquired Federal coal leases, and what they have done with those leases. It identifies the participants in the Federal coal leasing program between 1950 and 1980, traces the ownership on a lease-by-lease basis, and discusses the business activities and organizational structures of the lessees.

40204 **(PB—81-240319) Coal resources and sulphur emission regulations: a summary of eight eastern and midwestern states. Final report April 1979-March 1981.** Chapman, R.A.; Wells, M.A. (Versar, Inc., Springfield, VA (USA)). May 1981. 112p. NTIS, PC A06/MF A01.

The report gives results of an analysis of coal resources, current coal use, and the effectiveness of SO2 control strategies for use by coal users, regulators, and administrators in future coal-related decisions. The report focuses on the eight major eastern and midwestern coal-producing states: Alabama, Illinois, Kentucky, Ohio, Pennsylvania, Virginia, West Virginia, and Indiana. Each state's analysis includes a general overview of the coal industry, an overview of coal properties, a description of major coal seams, an analysis of the quantity of coal available to meet various SO2 emission regulations, and information regarding the sulfur content of coals used by utilities in 1979. The report emphasizes physical coal cleaning and the use of low-sulfur coal as viable emission control strategies; flue gas desulfurization is discussed to a lesser extent. Data on

coal resources, coal properties and washability, coal production, and deliveries to utilities were compiled from several sources and organized into computer data bases. The Coal Assessment Processor model was developed to operate on these data bases to determine the quantity of coal that would be available in each state to meet various SO2 emission regulations using one or a combination of alternative SO2 control technologies.

02 PETROLEUM

0201 Reserves

REFER ALSO TO CITATION(S) 40653

0202 Geology And Exploration

40205 **(PB—81-197329) Electrical earth resistivity surveys near brine holding ponds in Illinois. Environmental geology notes.** Reed, P.C.; Cartwright, K.; Osby, D. (Illinois State Geological Survey, Urbana (USA)). Apr 1981. 37p. NTIS, PC A03/MF A01.

Electrical earth resistivity surveys were conducted in the vicinity of five oil field brine holding ponds to develop a methodology for identifying elevated levels of soluble salts near oil fields. The five sites, all in similar hydrogeologic environments, were distributed across the main oil producing region of Illinois. Four of these sites were selected for detailed study of a possible relationship between changes in apparent electrical earth resistivities and changes in water quality.

40206 **(PB—81-865339) Offshore oil and gas operations: Africa. January, 1974-may, 1981 (Citations from Oceanic Abstracts). Report for January 1974-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 45p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning various aspects of offshore Africa oil and gas operations. Topics include oil and gas exploration, drilling, production, and equipment. Some attention is given to political, economic, and environmental considerations. (Contains 43 citations fully indexed and including a title list.)

40207 **(PB—81-865537) Offshore oil and gas operations: Australia. January, 1974-May, 1981 (citations from Oceanic Abstracts). Report for January 1974-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 52p. NTIS PC N01/MF N01.

Citations in this retrospective bibliograhy cover offshore oil and gas operations in Australia. Topics include offshore exploration, drilling, construction, structures, and production. Some attention is given to pollution aspects of offshore operations and to prospects for successful operations. (Contains 48 citations fully indexed and including a title list.)

40208 **(PB—81-865545) Offshore oil and gas operations: Southeast Asia. January, 1974-May, 1981 (citations from Oceanic Abstracts). Report for January 1974-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 38p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning offshore oil and gas leases, operations, and production in Southeast Asia. Exploration, drilling, construction, and completion are considered as are structures and equipment. Some attention is given to political and economic factors affecting development and production and to future prospects for oil and gas from this region. (Contains 34 citations fully indexed and including a title list.)

40209 **(PB—81-865750) Alaskan oil and gas operations. Jancuary, 1974-May, 1981 (citations from Oceanic abstracts). Report for January 1974-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 50p. NTIS PC N01/MF N01.

Citations in this retrospective bibliography cover Alaskan offshore oil and gas prospects and developments. Topics include exploration, operations, and production. Considerable attention is given to geological formations associated with known and potential deposits. Environmental considerations are excluded. (Contains 49 citations fully indexed and including a title list.)

0203 Drilling And Production

REFER ALSO TO CITATION(S) 40164, 40206, 40207, 40208, 40209, 40227, 40653

40210 **(DOE/BC/10082—8) Adsorption from flooding solutions in porous media: a study of interactions of surfactants and polymers with reservoir minerals. Annual report.** Somasundaran, P. (Columbia Univ., New York (USA). School of Engineering and Applied Science). Jun 1981. Contract AC19-79BC10082. 228p. NTIS, PC A11/MF A01. Order Number DE82009072.

Past studies on the interactions of sulfonates with dissolved inorganics showed that sulfonates precipitated by multivalent ions can undergo redissolution upon increasing either the sulfonate or NaCl concentration. At higher sulfonate and NaCl levels the surfactant reprecipitated. These studies also showed redissolution to occur only in the presence of micelles. The role of mechanisms involving such factors as complexation seems to be minimal under the conditions studied. Since the phenomenon of redissolution can be beneficially used for minimizing the surfactant loss due to precipitation, investigation of this phenomenon was continued during the current year. The objectives of this study were to develop a quantitative understanding of the molecular mechanisms involved and to formulate a model with predictive capabilities for the precipitation behavior of surfactant/inorganic ions systems. Towards this purpose, precipitation/redissolution/reprecipitation behavior of sulfonates was studied as a function of relevant variables including surfactant and salt concentration, surfactant chain length, alcohol and oil concentration and temperature.

40211 **(DOE/ET/12017—T1) Research on chemical oil-recovery systems. Annual report.** Shah, D.O.; Walker, R.D. Jr.; Butler, G.B.; O'Connell, J.P.; Schweyer, H.E. (Florida Univ., Gainesville (USA). Engineering and Industrial Experiment Station). 1 Dec 1977. Contract AS05-77ET12017. 188p. NTIS, PC A09/MF A01. Order Number DE82008389.

Progress reports for the year are presented for the following areas of investigation: (1) interfacial phenomena (unified theory of ultra-low interfacial tension, mechanisms of achieving ultra-low interfacial tension for pure surfactant solution systems, effect of pure dissolved oils on effective CMC of micellar solutions, solubilization, phase behavior and optimal salinity of mixed oil systems, radio frequency impedance characteristics of microemulsions and micellar solutions); (2) bulk emulsion and porous media rheology (oil displacement efficiency of high salt tolerant formulation, optimization of soluble oils for tertiary oil recovery, emulsion and porous media rheology); (3) polymer rheology and fluid mechanics (molecular and rheological characterization of polymers, surfactant-polymer interaction); (4) mineral characterization and rock/fluid interactions (ultra-violet absorption spectra of alkylbenzene sulfonates, salting-out of anionic surfactants, calcium tolerance of anionic surfactants, rock/fluid interactions in packed beds, electrolyte dependence of surfactant CMC); (5) thermodynamic and physical properties. (ATT)

40212 **(PB—81-201162) Petroleum industry in Illinois, 1979. Annual report.** Van Den Berg, J.; Elyn, J.R. (Illinois State Geological Survey, Urbana (USA)). 1981. 132p. NTIS, PC A07/MF A01.

Illinois produced 21,792,755 barrels of crude oil in 1979, a decrease of 6.7 percent from 1978. The value of this crude oil is estimated to be $436 million. Secondary recovery production was estimated at 12,249,100 barrels of crude oil. Waterfloods accounted for 12,114,300 barrels, or 55.6 percent of the state total; and pressure maintenance projects reported 134,800 barrels, or 0.6 percent of the state total.

40213 **(PB—81-865768) Pollution from Alaskan oil and gas operations. January, 1974-May, 1981 (citations from Oceanic Abstracts). Report for January 1974-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 56p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning environmental pollution mechanisms and effects associated with Alaskan oil and gas operations. Effects at specific locations and upon specific species are considered. Some attention is given to legal aspects of oil spills and other oil pollution sources. (Contains 54 citations fully indexed and including a title list.)

0204 Processing

REFER ALSO TO CITATION(S) 40128, 40131, 40225

40214 **(PB—81-855918) Zeolites in catalysis. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 181p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning catalytic effects of zeolites and zeolite-containing catalysts in the catalytic cracking, reforming, and refining of hydrocarbons from fossil fuels; i.e. petroleum, coal liquids, etc. The use of zeolites as catalyst supports in the chemical preparation of hydrocarbons from methanol is covered, as is their use in desulfurizations and in the reduction of nitrogen oxides. (Contains 181 citations, fully indexed and including a table of contents.)

40215 **(PB—81-855926) Zeolites in catalysis. January 1970-November 1980 (citations from the Engineering Index Data Base). Report for January 1970-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 103p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning catalytic effects of zeolites and zeolite-containing catalysts in the catalytic cracking, reforming, and refining of hydrocarbons from fossil fuels; i.e. petroleum, coal liquids, etc. The use of zeolites as catalyst supports in the chemical preparation of hydrocarbons from methanol is covered, as is their use in desulfurizations and in the reduction of nitrogen oxides. (Contains 90 citations, fully indexed and including a table of contents.)

40216 **(PB—81-856726) Gasoline refining. January 1970-December 1980 (citations from the Engineering Index Data Base). Report for January 1970-December 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 131p. NTIS PC N01/MF N01.

The citations cover global information on various techniques for refining natural and synthetic gasolines and their by-products. Extending octane upgrading processes, product testing, recovery of aromatics, and improving refinery economics are also included. (Contains 143 citations, fully indexed and including a table of contents.)

0205 Products And By-products

REFER ALSO TO CITATION(S) 40246

40217 **(PB—82-854456) Antioxidants and stabilizers for lubricants and fuels. January, 1970-October, 1981 (citations from the NTIS Data Base). Report for Jan 70-Oct 81.** (National Technical Information Service, Springfield, VA (USA)). Oct 1981. 114p. NTIS PC N01/MF N01.

The bibliography cites reports dealing with antioxidant and stabilizing additives to lubricants, oils, and fuels, such as mineral oils and jet engine fuels. Studies are presented which discuss the synthesis, mechanisms, properties, and thermal and storage stabilities of these additives. (This updated bibliography contains 94 citations, 32 of which are new entries to the previous edition.)

0206 Health And Safety

REFER ALSO TO CITATION(S) 41670

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 40247

40218 **(AD-A—104016/1) Defense energy information system (DEIS): DEIS-80 design system specification. revision a. Task report.** Lengel, J. (Logistics Management Inst., Washington, DC (USA)). Jul 1981. Contract MDA903-81-C-0253. 220p. NTIS, PC A10/MF A01.

The Defense Energy Information System (DEIS) is a worldwide, automated, energy management information system. It provides data on petroleum products used as mobility fuels by the military departments as well as most energy sources used for utility services at DoD installations. DEIS consists of two related information systems. DEIS I reports the disposition and consumption of petroleum products, notably aviation gasoline, jet fuels, motor gasoline, distillate and residual oils within DoD. DEIS II reports the consumption of utility energy, such as electricity, natural gas, purchased steam/hot water, fuel oil and coal. It reports the consumption and generation of energy from renewable sources. This document presents the System Specification for the enhanced DEIS (DEIS-80). As specified, DEIS-80 improves the utility of the existing system by including additional data, supporting management queries of the DEIS-80 data bases on-line, and providing the capability for automated data analysis. Since the publication of the DEIS-80 specifications in August 1980, several design features have been identified that required clarification and modification. The design System Specification will continue to serve as the guide for the computer programming of DEIS-80. It adheres to the requirement for system specification in the 'Automated Data System Documentation Standards.

40219 **(EMD—82-34) Accelerated onshore oil and gas leasing may not occur as quickly as anticipated. Report to the Chairman, Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 8 Feb 1982. 63p. General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

One of President Reagan's goals is to encourage development of the Nation's energy resources by providing greater access to Federal lands and streamlining the leasing process. However, (1) the administration has not progressed as quickly as it had anticipated in accelerating access to additional lands for onshore oil and gas leasing and (2) problems with the present leasing system may prevent a significant increase in leasing in the near future even if greater access is achieved. The Department of the Interior needs to take a realistic look at how it can significantly increase onshore oil and gas leasing in view of problems in the system and its staffing and budgetary constraints.

40220 **(EMD—82-62) Leasing storage capacity for the Strategic Petroleum Reserve.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 12 Mar 1982. 5p. General Accounting Office, Washington, DC 20548.

Portions of document are illegible.

Oil storage requirements and costs associated with achieving the 300,000 barrels-per-day fill rate goal by leasing existing storage capacity are presented. To maintain a 300,000 barrel-per-day fill rate until the first 500 million barrels of oil are stored, DOE would have to lease temporary storage capacity for over 4 years. (DMC)

40221 **(PB—81-141319) Analysis of the world oil market. Final report, 1 March 1975-28 February 1978.** Jacoby, H.D. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). 1 Apr 1978. 50p. NTIS, PC A03/MF A01.

The world oil market was analyzed using two types of models, one representing capital behavior and the other, a detailed simulation model of market supply and demand. The investigation

involved a set of studies of oil supply from key producer areas, impact demand from major consumers, and integration of estimated supply and demand functions into a simulation model for studying future developments. The simulation framework was combined with a separate set of behavioral models of the cartel-core nations and their price-setting decisions, together with studies of evolving contract arrangements, trade patterns, and financial factors. This research increases understanding of the workings of the world oil market and the likely effects of various national policies. The report includes forecasts of likely future paths; studies of possible causes of cartel instability; evaluation of various consumer and producer policies; and a study of likely patterns in oil and their implications for national security and international finance. Extensive reference abstracts are included.

40222 **(PB—81-145252) World petroleum availability 1980-2000. Report OTA-TM-E-5.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Oct 1980. 88p. NTIS, PC A05/MF A01.

This report was prepared in response to a request from the Senate Foreign Relations Committee for a review of global energy trends. It estimates plausible levels of world oil production to the year 2000, and assesses the factors likely to determine which levels are actually reached. The study critically examines country-by-country capabilities for oil production, various estimates of what each country will actually produce, and prospects for new discoveries.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 40213, 40869, 41368, 41439, 41443

40223 **(NP—2903650) Proposed 1982 Outer Continental Shelf oil and gas lease sale offshore the North Atlantic States. Final environmental impact statement. OCS Sale No. 52.** (Bureau of Land Management, New York (USA). New York Outer Continental Shelf Office). Apr 1982. 620p. United States Dept. of the Interior, Bureau of Land Management, New York Outer Continental Shelf Office, 26 Federal Plaza, Suite 32-120, New York, NY 10278.

Portions of document are illegible.

The proposed action is the offering of 540 tracts (3.1 million acres; 1.2 million hectares) located from 86 to 164 statute miles offshore southeast Cape Cod and Nantucket Island, Massachusetts for leasing in accordance with the Outer Continental Shelf Lands Act, as amended. The tracts lie in average water depths of 52 to 2830 meters (171 to 9285 feet). If implemented, this sale is tentatively scheduled for October, 1982. Under the proposed five-year leasing schedule, which should be approved in July, 1982, Sale No. 52 would be held in August, 1982. Alternatives considered include a delay of the sale, cancelling the sale (no action), and six deletion options. The deletion options include: one to protect fisheries and other biological resources; one to protect resources located in canyon heads; one relating to deepwater concerns; one involving those tracts containing possible sediment slump; an alternative that considers the Georges Bank as a Marine Sanctuary; and one alternative that considers those tracts at the top of Georges Bank lying within the 60-meter isobath. All tracts studied pose some degree of risk to the environment. Mitigating measures, which may reduce the risk, have been identified.

40224 **(PB—81-141137) Petroleum biodegradation potential of northern Puget Sound and Strait of Juan de Fuca environments. Final report, August 1978-October 1979.** Westlake, D.W.S.; Cook, F.D. (Alberta Univ., Edmonton (Canada)). Jun 1980. 147p. NTIS, PC A07/MF A01.

The oil-degrading activity of the microbial flora present in marine samples from three sites in the northern Puget Sound-Samish Bay, E. Fidalgo and Pt. Partridge and several sites in the Pt. Angeles area were investigated in this study. Activity was measured in terms of changes in the n-alkane and isoprenoid gas chromatographic profile of the saturate fraction and reported in terms of a Degradative Capacity Index. Oil-degrading activity was greatest in areas adjacent to oil refineries and areas of relatively high levels of commercial activity. The levels of nitrogen and phosphorus were the primary environmental factors controlling the activity of the oil-degrading microbial flora. The fact that oil-degrading bacterial populations were readily isolated under enrichment conditions similar to those existing in the natural environment whereas fungi and yeast were only obtained under selective enrichment conditions (i.e. low pH) suggests that bacteria would be the most active group in removing oil spilled from this environment. Oil-degrading populations consisted predominantly of Flavobacterium and Pseudomonas genera with occasional populations containing a predominance of members of Acinetobacter and Alcaligenes genera.

40225 **(PB—81-199382) Evaluation of the walkthrough survey method for detection of volatile organic compound leaks. Final report.** Weber, R.C.; Mims, K. (Environmental Protection Agency, Cincinnati, OH (USA). Industrial Environmental Research Lab.). Apr 1981. 70p. NTIS, PC A04/MF A01.

During 1978 and 1979, the Emission Standards and Engineering Division of EPA's Office of Air Quality Planning and Standards conducted a fugitive volatile organic compound (VOC) emission sampling program in organic chemical manufacturing plants and petroleum refineries. As a part of their sampling program, several 'walkthrough surveys,' also called 'unit area surveys,' were conducted. The assistance of EPA's Industrial Environmental Research Laboratory, Cincinnati was requested in the analysis of the walkthrough survey data. Fourteen walkthrough surveys were analyzed, from four plants. The analysis reported here focuses on the variability and reproducibility of the survey method. One indicator of variability which was studied was the coefficient of variation (CV). The CV's ranged from 55% to 408%, for each pair of walkthrough surveys. Further, the linear correlation coefficients for each set of surveys ranged from 0.046 to 0.98. No attempt was made to evaluate the sources of the variability.

40226 **(PB—81-240178) OCS oil and gas proposed 1981 sales A66 and 66: draft environmental impact statement.** Bartz, M.R.; Verinder, S.H. (Bureau of Land Management, New Orleans, LA (USA). New Orleans Outer Continental Shelf Office). Jul 1980. 169p. NTIS, PC A08/MF A01.

This environmental impact statement is a description of the environmental aspects and impacts of oil and gas activities resulting from these sales for the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed action, issues and areas of concern, and the major alternatives of holding these sales.

40227 **(PB—81-240186) Potential environmental problems of enhanced oil and gas recovery techniques. Final report.** Beck, R.; Shore, R.; Scriven, T.A.; Lindquist, M. (Energy Resources Co., Inc., Cambridge, MA (USA)). Aug 1981. 297p. NTIS, PC A13/MF A01.

This report provides: (a) an identification of and analysis of available data regarding EOR/EGR related pollutants; (b) an assessment of potential environmental impacts and an identification of possible controls; and (c) recommendations as to research needs. The following processes were studied: steam injection, in situ combustion, carbon dioxide miscible flooding, micellar/polymer flooding, alkaline flooding, improved waterflooding, advanced hydraulic fracturing, chemical explosive fracturing, and directional drilling. The existing EOR/EGR environmental impact information (published and unpublished) is critically reviewed and summarized. The effect of EOR/EGR processes on air quality, groundwater quality, water quantity, noise levels, and secondary impacts is the main area of analysis.

40228 **(PB—81-241051) Proposed 1981 outer continental shelf oil and gas lease sale No. 56: final environmental impact statement.** (Bureau of Land Management, New Orleans, LA (USA). New Orleans Outer Continental Shelf Office). Jan 1981. 559p. NTIS, PC A24/MF A01.

This EIS (Environmental impact statement) is a description of the environmental aspects and impacts of oil and gas activities resulting from this sale for the states bordering the South Atlantic. It provides a description of the area, affected environment, and en-

vironmental consequences; it discusses the proposed action, issues and areas of concern, and the major alternatives of holding the sale.

40229 **(PB—81-241069) Proposed 1981 outer continental shelf oil and gas lease sale No. 56: draft environmental impact statement.** (Bureau of Land Management, New Orleans, LA (USA). New Orleans Outer Continental Shelf Office). Jul 1980. 422p. NTIS, PC A18/MF A01.

This EIS (Environmental Impact Statement) is a description of the environmental aspects and impacts of oil and gas activities resulting from this sale for the states bordering the South Atlantic. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed action, issues and areas of concern, and the major alternatives of holding the sale.

40230 **(PB—81-241952) Proposed OCS oil and gas sales 67 and 69: draft environmental impact statement.** (Bureau of Land Management, New Orleans, LA (USA). New Orleans Outer Continental Shelf Office). Mar 1981. 437p. NTIS, PC A19/MF A01.

Portions of document are illegible.

This EIS (Environmental Impact Statement) is a description of the environmental aspects and impacts of oil and gas activities resulting from these sales for the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed action, issues and areas of concern, and the major alternatives of holding these sales.

40231 **(PB—81-242018) OCS oil and gas proposed 1981 sales a66 and 66: final environmental impact statement.** Bartz, M.R.; Verinder, S.H. (Bureau of Land Management, New Orleans, LA (USA). New Orleans Outer Continental Shelf Office). Dec 1980. 243p. NTIS, PC A11/MF A01.

This EIS (Environmental Impact Statement) is a description of the environmental aspects and impacts of oil and gas activities resulting from these sales for the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed action, issues and areas of concern, and the major alternatives of holding these sales.

40232 **(PB—81-242810) Proposed 1979 Outer Continental Shelf oil and gas lease sale 58 western and central Gulf of Mexico: final environmental impact statement, Volume 1.** (Bureau of Land Management, New Orleans, LA (USA). New Orleans Outer Continental Shelf Office). Feb 1979. 453p. NTIS, PC A20/MF A01.

This environmental impact statement is a description of the environmental aspects and impacts of oil and gas activities resulting from this sale for the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed action, issues and areas of concern, and the major alternatives of holding the sale.

40233 **(PB—81-244329) Proposed 1979 Outer Continental Shelf oil and gas lease sale 58 western and central Gulf of Mexico: draft environmental impact statement, Volume 1.** (Bureau of Land Management, New Orleans, LA (USA). New Orleans Outer Continental Shelf Office). Jan 1979. 444p. NTIS, PC A19/MF A01.

This environmental impact statement is a description of the environmental aspects and impacts of oil and gas activities resulting from this sale for the states bordering the Gulf of Mexico.

40234 **(PB—81-244337) Proposed 1979 Outer Continental Shelf oil and gas lease sale 58a western and central Gulf of Mexico: final environmental impact statement, Volume 1.** (Bureau of Land Management, New Orleans, LA (USA). New Orleans Outer Continental Shelf Office). Jun 1979. 421p. NTIS, PC A18/MF A01.

This environmental impact statatement is a description of the environmental aspects and impacts of oil and gas activities resulting from this sale for the states bordering the Gulf of Mexico.

40235 **(PB—81-244790) Performance testing of the Soviet oil/debris skimmer. Final report.** Lichte, H.W. (Mason and Hanger-Silas Mason Co., Inc., Leonardo, NJ (USA); Environmental Protection Agency, Cincinnati, OH (USA). Municipal Environmental Research Lab.). Aug 1981. 42p. NTIS, PC A03/MF A01.

Performance evaluation of a Soviet oil skimmer was conducted at the United States Environmental Protection Agency's Oil and Hazardous Materials Simulated Environmental Test Tank in 1979. The skimmer was provided by the Black Sea Central Planning and Designing Bureau, Odessa. The test program was designed at OHMSETT to evaluate the oil skimming capability of a specially modified Soviet skimmer, Model 2550/4. The self-propelled vessel is 17.7 meters long and weighs 39 metric tons. The 111 kilowatt diesel engine drives a ducted propeller water jet propulsion system. The vessel is capable of five knots forward speed and skims effectively at speeds from zero to two knots. The unique combination of various weir designs into one system, vessel mobility, the efficient use of energy, a series type oil/water gravity separator, and the propulsion techniques all suggest it to be an effective harbor skimmer. The oil recovery rate of 12.4 cubic meters per hour was confirmed using OHMSETT heavy test oil (1.5 pascal seconds and 0.95 specific gravity) in calm water conditions. Recovery efficiency was 85 percent at 1.5 knots forward speed and throughput efficiency was 90 percent at one knot forward speed. Performance dropped for skimming light oils at faster speeds and higher wave conditions. The skimmer collected 64 percent of the 81.3 cubic meters oil volume encountered during the test program.

40236 **(PB—81-866592) Oil spills and oil pollution in the Arctic and Antarctic. January, 1970-May, 1981 (citations from Pollution Abstracts). Report for January 1970-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 38p. NTIS PC N01/MF N01.

Citations in this retrospective bibliography cover the environmental and biological consequences of oil spills and oil pollution in the arctic regions. Topics include prevention, detection, behavior, control, and recovery of arctic oil spills and pollution. Some attention is given to effects upon particular biological species. (Contains 40 citations fully indexed and including a title list.)

40237 **(PB—82-101353) Performance testing of four skimming systems. Final report.** Lichte, H.W.; Breslin, M.K.; Smith, G.F.; Graham, D.J.; Urban, R.W. (Mason and Hanger-Silas Mason Co., Inc., Leonardo, NJ (USA)). Sep 1981. Contract EPA-68-03-2642. 92p. NTIS, PC A05/MF A01.

Performance tests were conducted at the U.S. Environmental Protection Agency's oil and hazardous simulated environmental test tank (OHMSETT) on four commercial oil spill cleanup devices: the Sapiens Sirene skimming system, the Oil Mop remote skimmer, the Troil/Destroil skimming system, and the Versatile Bennett arctic skimmer. The objective of the test program conducted during the 1979 test season was to evaluate skimmer performance in collecting oil floating on water using several wave conditions, tow speeds, and skimmer operating parameters. Tests described in this report were sponsored by the OHMSETT Interagency Technical Committee (OITC). Members of the 1979 OITC were the U.S. Environmental Protection Agency, U.S. Navy-SUPSALV, U.S. Navy-NAVFAC, U.S. Coast Guard, U.S. Geological Survey, and Environment Canada. A 16-mm film report, entitled '600 Foot Ocean', was produced to summarize the results presented in this report. This film is available through the U.S. Environmental Protection Agency, Office of Research and Development, Oil and Hazardous Materials Spills Branch, Edison, New Jersey 08837.

40238 **(PB—82-101684) Dispersant application system for the U.S. coast guard 32-foot WPB (waterways patrol boat). Final report.** Borst, M.; Smith, G.F. (Mason and Hanger-Silas Mason Co., Inc., Leonardo, NJ (USA)). Sep 1981. Contract EPA-68-03-2642. 32p. NTIS, PC A03/MF A01.

This illustrated report describes details of the fabrication, assembly, and operation of a lightweight, easily assembled system for dispensing chemical dispersants on oil spills. This system is designed to be fitted onto the aft deck of the U.S. Coast Guard 32-

foot waterways patrol boat (WPB), a vessel stationed in many areas where oils are commonly transferred or transported. This report is intended to provide those detailed instructions necessary to the man actually doing the fabrication, assembly, or operation. Sixteen illustrations and parts lists are also provided.

40239 **(PB—82-800129) Ground water pollution. 1964-January, 1981 (citations from the American Petroleum Institute Data Base). Report for 1964-Jan 81.** (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 186p. NTIS PC N01/MF N01.

The bibliography contains abstracts of worldwide research on the contamination of ground water, especially from petroleum and petrochemical sources. Causes, phenomena, prevention, control, and analysis are among the subjects covered. (This updated bibliography contains 177 citations, 21 of which are new entries to the previous edition.)

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 40893, 40895

40240 **(NP—2750041) Law No. 106 of 11 Mar 1981 about participation of the state in petroleum supplies.** 11 Mar 1981. 1p. (In Danish). Risoe Library, DK-4000 Roskilde, Denmark.

The law provides the participation of the Danish state-owned company DONG (Danish Oil and Natural Gas A/S) in import of crude oil and oil products.

40241 **(PB—81-239527) State participation in OCS development and production decisions. Staff draft.** Murphy, M.; Purnell, J. (New England River Basins Commission, Boston, MA (USA)). Jul 1980. 75p. NTIS, PC A04/MF A01.

The draft technical report deals with state participation in the OCS exploration, development and production, transportation and onshore facilities decision making processes. The report describes the opportunities for state participation in the development and production stage and outlines the way three states coordinate their participation.

40242 **(PB—81-854572) Legal aspects of offshore operations. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 88p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning national and international laws and national legislation concerning offshore energy systems, oil and gas operations, marine resources, offshore mining operations, and offshore structures. (Contains 78 citations, fully indexed and including a table of contents.)

0220 Transport, Pipelines, And Handling

40243 **(PB—81-140907) Trans-Alaska Oil Pipeline operations: more federal monitoring needed. Report to the Congress.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 6 Jan 1981. 152p. NTIS, PC A08/MF A01.

This report evaluates the effectiveness of the Department of the Interior's monitoring of Trans-Alaska Oil Pipeline System operations.

0230 Properties

REFER ALSO TO CITATION(S) 40217

40244 **(AD-A—098258/7) Infrared analysis of gasoline/alcohol blends. Interim report.** Newman, F.M.; Biela, S.M. (Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.). Feb 1981. 30p. (AFLRL—134). NTIS PC A03/MF A01.

An infrared method for qualitative and quantitative determination of alcohols in gasoline/alcohol blends has been developed. The method has high potential for speed, low cost, and specificity. Gasoline containing methanol, ethanol, iso-propanol, t-butanol, methyl t-butyl ether, and methyl iso-butyl ketone (MIBK) can be analyzed using a computing infrared spectrophotometer. Due to variable composition of different gasolines, each base gasoline analyzed required a new quantitative program to be established, using standards prepared with that particular gasoline.

40245 **(PB—81-140535) Worldwide analysis of marine Bunker C fuel oils. Final report.** (Presearch, Inc., Arlington, VA (USA)). Dec 1980. 60p. NTIS, PC A04/MF A01.

This survey provides the results of physical and chemical tests to determine the properties and components of 150 samples of marine Bunker C fuel oil. These samples are as bunkered samples and represent 75 ports of the world from eight geographic regions as collected by 28 participating companies. The test results are presented in world port index sequence by geographic region. Minimum, maximum, and average values were calculated for each test by geographic region and in total and are presented by test. The standard deviation for each test is also included as a measure of variability of the test results. An example of the possible use of the standard deviation is included. This example assumes a normal distribution of sample results. The survey results presented herein should prove useful when considering Bunker C procurements or future engine design and maintenance policies.

40246 **(PB—81-244980) Testing of six engine oils in accordance with the 'EPA recommended practice for testing, grading and labeling the fuel efficiency of motor vehicle engine oils'. Technical report.** Hutchins, F.P.; Penninga, T.J. (Environmental Protection Agency, Ann Arbor, MI (USA)). May 1981. 97p. (EPA-AA-TEB—81-16). NTIS, PC A05/MF A01.

In January/February 1980, the EPA assembled the 'EPA Recommended Practice for Evaluating, Grading and Labeling the Fuel Efficiency of Motor Vehicle Engine Oils' (Appendix 1). This procedure used the ASTM approach for carryover oils and incorporated four fuel economy grades for engine oils as well as a label for identification. In March 1980, the EPA initiated a testing program in accordance with the EPA recommended procedure, using two sets of test vehicles to evaluate the feasibility of the procedure. This report covers the results of that testing.

0240 Storage

REFER ALSO TO CITATION(S) 40220

40247 **(DOE/EP—0046) Strategic petroleum reserve, quarterly report.** (Department of Energy, Washington, DC (USA). Office of Strategic Petroleum Reserve). 16 Feb 1982. 14p. NTIS, PC A02/MF A01. Order Number DE82009173.

As of December 31, 1981, the cumulative fill capability for the storage of crude oil for the SPR was 257 million barrels. Development of Phase I of the program consisting of 250 million barrels of capacity is complete and development of Phase II, consisting of 290 million barrels of capacity, is continuing. During 1981, the design of Phase III commenced. Phase III will increase the SPR capacity by 210 million barrels. The cumulative fill capability is expected to be 750 million barrels by 1990. The SPR was filled at a rate of 338,391 barrels per day during the last quarter of 1981, and had a total of 230.3 million barrels of oil in storage at the end of 1981. The Department of Energy has aggressively pursued oil purchases during 1981 in order to take advantage of the favorable international oil market. A long-term commercial contract was signed on August 20, 1981, with Petroleos Mexicanos (PEMEX), Mexico's state-owned oil company, for purchase of 110 million barrels of crude oil through 1986. The contract provided for the SPR to purchase 24 million barrels between September 1, 1981, and December 31, 1981. Thereafter PEMEX will supply crude oil to the SPR at the rate of 50,000 barrels a day through August 31, 1986. In addition, under the terms of a settlement of an overcharge allegation, Chevron USA agreed to supply 1,029,000 barrels of oil to the Reserve without cost. Deliveries under this settlement were completed in January 1982. The Omnibus Budget Reconciliation Act also re-

quires the Secretary of the Treasury to establish an account to be known as the SPR Petroleum Account which may be obligated for the acquisition, transportation, and injection of petroleum products into the SPR. For FY 1982, Congress appropriated $3.7 billion to this account. The amount of funds obligated from the SPR Petroleum Account during the first quarter FY 1982 ending December 31, 1981, was $2056 million.

0250 Combustion

REFER ALSO TO CITATION(S) 41280

40248 **(PB—81-856791) Oil burners. January 1970-December 1980 (citations from the Engineering Index Data Base). Report for January 1970-December 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 161p. NTIS PC N01/MF N01.

This retrospective bibliography contains worldwide information on design, construction, and materials for oil burners using crude oil fuel or shale oil fuel. Topics on low excess air burners, dual fuel burners, reduction of pollutants and ultrasonic jet atomization in burners are also included. (Contains 176 citations, fully indexed and including a table of contents.)

40249 **(PB—82-102351) Fuel Nox control by catalytic combustion. Final report Oct 78-Apr 79.** Chu, E.K.; Seifert, K.D.; Kendall, R.M.; Kesselring, J.P. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). Sep 1981. Contract EPA-68-02-2611. 103p. NTIS, PC A06/MF A01.

The report gives results of an experimental study to: (1) define operating conditions for catalytic combustors that give low levels of NOx emissions for fuelbound nitrogen compounds, and (2) quantitatively determine the fate of fuel nitrogen during catalytic combustion. Tests were conducted with platinum and nickel oxide catalysts over a range of test conditions, using ammonia and methylamine as model fuel nitrogen compounds. Fuel NOx emissions were found to be strongly dependent on catalyst type; however, varying mass throughput, bed temperature, fuel, and fuel nitrogen type had virtually no effect on fuel NOx. The dominant nitrogenous products resulting from the catalytic combustion of a nitrogen-containing fuel were NO, N_2, NH_3, and HCN.

03 NATURAL GAS

0301 Reserves

REFER ALSO TO CITATION(S) 40653

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 40206, 40207, 40208, 40209

40250 **(PB—82-103821) Studies related to the deep earth gas. Final report Sep 79-Dec 80.** Gold, T.; Bilson, E.; Soter, S. (Cornell Univ., Ithaca, NY (USA). Center for Radiophysics and Space Research). 8 May 1981. Contract GRI-5014-363-0205. 40p. NTIS, PC A03/MF A01.

The purpose of this research is to elucidate the origin of terrestrial hydrocarbons, principally of methane and petroleum and to determine the importance of the abiogenic methane component in natural gas, which originates at much greater depth than the organic methane, from meteoritic carbonaceous matter accumulated in the mantle at the time of the earth's formation. Experiments include (1) inverse cracking designed to study the conditions for methane addition to petroleum hydrocarbons; (2) isotope analysis of methane gas samples collected in geopressured wells, tectonically active regions, and seeps of possibly abiogenic origin; and, (3) construction and testing of a ground gas pressure-monitoring unit to be used for the investigation of the relationship of earth outgassing and tectonic processes.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 40206, 40207, 40208, 40209, 40213, 40653

40251 **(PB—81-865735) Natural gas processing plant technology, equipment, and facilities. January, 1976-May, 1981 (citations from the Energy Data Base). Report for January 1976-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 265p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the design, operation, and performance of natural gas processing facilities, equipment, and processes for natural gas from various sources. Economic, environmental, and regulatory aspects of natural gas processing are considered. Some attention is given to specific locations, instrumentation, equipment, and processes. (Contains 300 citations fully indexed and including a title list.)

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 40219

0308 Environmental Effects

REFER ALSO TO CITATION(S) 40213, 40226, 40227, 40228, 40229, 40230, 40231, 40232, 40233, 40234

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 40227, 40869

40252 **(DOE/DP/00053—1123) Eastern gas shales mineback report: site assessment - Phase I.** Overbey, W.K.; Sawyer, W.K.; Shuck, K.Z.; Zielinski, R.E. (Mound Facility, Miamisburg, OH (USA)). 1981. Contract AC04-76DP00053. 209p. (MLM-MU—82-61-0003). NTIS, PC A10/MF A01. Order Number DE82009044.

The technology development and demonstration program herein described resulted from an assessment of the state-of-the-art problems of gas recovery, from the Eastern Devonian Shales. After ten years of Devonian Shale research, the remaining major issues for developing the shale resource have been defined and this project was formulated to address those specific recovery problems. This document provides the rationale and criteria for selecting and evaluating a site for a mineback type project and the experimental results obtained from a one hundred and twenty day on-site testing and evaluation plan. The site selected as the best overall candidate for on-site testing was Sugarloaf Mountain, which is located about six miles off the Interstate I-64 exit at Morehead, Kentucky. The on-site testing included obtaining a core through the Ohio shale interval, core analysis, in-situ stress measurements from five boreholes, gas pressure buildup, natural fracture and joint mapping, hydraulic fracture orientation mapping, photogeology and a thorough study of the geology and gas shale reservoir history in the area. Results of the site evaluation data obtained to date indicate the site to be a very favorable one for conducting the planned mineback experiments and future development, testing and demonstration of Devonian Gas shales recovery technology.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 40241

40253 **(NP—2750042) Order No. 44 of 1 April 1981 on the agreement of 29 Feb 1980 between the Governments of Denmark and Sweden about cooperation in natural gas.** 1 Apr 1981. 2p. (In Danish). Risoe Library, DK-4000 Roskilde, Denmark.

A cooperation between Danish and Swedish state companies will consist in sale of the North Sea gas to Sweden and develop-

ment of gas distribution network, as well as mutual help in case of interruptions in supplies (EG).

0320 Transport, Pipelines, And Handling

40254 (PB—82-101197) Recommended cost/schedule control system for federal inspector, Alaska Natural Gas Transportation System. Paper (final). McCullough, J.D. (Institute for Defense Analyses, Arlington, VA (USA)). Jun 1981. Contract OFI-80-16280775. 141p. NTIS, PC A07/MF A01.

The purpose of this paper is to recommend a Cost/Schedule Control System (C/SCS) for the Federal Inspector's use which will enable actual cost, schedule and progress information to be compared with approved plans, variances noted, trends perceived, and corrective actions taken. This paper begins with a description of the management objectives relating to the C/SCS, and of the general requirements for reports on cost, schedule and progress. The general requirements are then tailored to meet the specific situation of each sponsor (firm that is building a segment of the ANGTS): first, under a fixed price contracting environment; then for the Alaska segment under a non-fixed price contracting environment. Summary C/SCS reports to the President and the Congress are discussed. An appendix provides a summary of the cost format criteria approved by the Federal Energy Regulatory Commission for use by ANGTS sponsors.

0330 Properties

REFER ALSO TO CITATION(S) 41195

0340 Combustion

REFER ALSO TO CITATION(S) 40249

40255 (PB—81-202038) Upgrading seasonal efficiency of gas heating systems. Semiannual report. Loria, R.; DeWerth, D.W. (American Gas Association Labs., Cleveland, OH). Jun 1980. 59p. NTIS, PC A04/MF A01.

The objective of this program is to conserve gas by improving the seasonal efficiency of gas-fired appliances. This can be achieved by evaluating the effectiveness of retrofit techniques for improving existing appliances and by evaluating advanced technology with reported high or improved efficiency. The cyclic utilization efficiency test room was used to estimate the seasonal efficiency of two advanced technology appliances: an instantaneous hot water boiler and a condensing furnace. Potential energy savings were estimated for a contemporary counterflow furnace when retrofitted with the following techniques: (a) derate, (b) vent restriction, (c) vent dampers, and (d) combination of the above. Gas interchangeability studies were conducted with a flash back and yellow tip gas on two appliances retrofitted for energy savings.

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

40256 (NP—2904124) Preliminary evaluation of shale-oil resources in Missouri. Nuelle, L.M.; Sumner, H.S. (Missouri Dept. of Natural Resources, Rolla (USA). Div. of Geology and Land Survey). Feb 1981. 46p. Missouri Dept. of Natural Resources, Division of Geology and Land Survey, P.O. Box 250, Rolla, MO 65401 $3.00 + postage and handling.

This report is a preliminary overview of oil-shale potential in Missouri. Two types of oil shales occur in Missouri: (1) the platform marine type, represented by the Devonian Chattanooga Shale, and (2) black shales in Pennsylvanian cyclothems, many of which overlie currently mined coal beds. The Chattanooga Shale contains black, fissile, carbonaceous shales and reaches a thickness of around 70 ft in southwestern Missouri. Oil-yield data from Missouri are not available, but based on yields from other states, the Chattanooga of southwest Missouri is estimated to contain between 2.6 and 15.8 billion barrels of oil. Preliminary estimates of the black, hard, fissile, carbonaceous Pennsylvanian shales indicate they contain between 100 and 200 billion barrels of shale oil. Many of these units directly overlie currently mined coal seams and could be recovered with the coal, but they are now discarded as overburden. These shales also contain significant amounts of phosphates and uranium. Other Paleozoic units with limited oil-shale potential are the Ordovician Decorah and Maquoketa Formations and the Upper Devonian Grassy Creek Shale. Ambitious research programs are needed to evaluate Missouri oil-shale resources. Further investigations should include economic and technological studies and the drilling, mapping, and sampling of potential oil-shale units. Shrinking supplies of crude oil make such studies desirable.

0403 Drilling, Fracturing, And Mining

40257 (LA—8956-PR) Explosively produced fracture of oil shale. Progress report, January to March 1981. (Los Alamos National Lab., NM (USA)). Jan 1982. Contract W-7405-ENG-36. 92p. NTIS, PC A05/MF A01. Order Number DE82009547.

This is the first Los Alamos Oil Shale progress report in a new format, designed to continue the publication of technical papers each quarter and to report the progress made each quarter in oil shale research. This first report describes the history of the project to put the present status in perspective and outlines the program and its objectives. In subsequent reports, program achievements will be reported along with the usual technical papers. Section I covers program management, explosive characterization, dynamic rock mechanics, field verification tests, and stress wave, fluid flow, and retort stabiliy modeling. Program history, recent accomplishments, and future plans are discussed for each program element. Details are also given on how the program dovetails with that of industry, particularly with the Oil Shale Consortium. Finally, the unique operational principles and field applications of the CORRTEX system to oil shale field experiments are explained. Section II presents several technical papers. An overview of the rock fragmentation effort to enhance the permeability of oil shale using explosives summarizes the project, its rationale, and objectives. Results of explosive characterization tests show that the maximum pressure and gas drive of ANFO are greatly enhanced by the addition of aluminum. In fracture modeling, spallation is studied in terms of crack growth, and the effect of anisotropy in explosive fragmentation is calculated and compared with radiograph data from field tests. Our TRACER model is explained and fluid flow calculations for heat and mass transfer in the Occidental Oil Shale, Inc. MR-3 retort are shown to compare well with field data. Also, the status of the two-dimensional retorting model, which fully couples retort chemistry with fluid dynamics, is given.

40258 (PB—81-808255) Oil shale mining, processing, uses, and environmental impacts. 1978-July 1981 (citations from the NTIS data base). Report for 1978-July 1981. (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 373p. NTIS PC N01/MF N01.

Government-funded research on exploration, mining, retorting, chemistry, environmental impacts, and policies relating to oil shale research is covered. Abstracts discuss such things as oil shale air and water pollution control, production of synthetic fuels, use of spent oil shale in road construction, identification of research and development priorities, and in situ recovery of shale oil. (This updated bibliography contains 366 citations, 160 of which are new entries to the previous edition.)

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 40085, 40088, 40258, 40260

40259 (PB—81-808263) Oil shale mining, processing, uses and environmental impacts. 1978-July 1981 (citations from the Engineering Index data base). Report for 1978-July 1981. (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 342p. NTIS PC N01/MF N01.

Worldwide research on exploration, mining, retorting, chemistry, thermal studies, environmental impacts, and policies relating to oil shale research is discussed. A few abstracts deal with the pro-

duction of synthetic fuels from shale oil and the economics of oil shale operations. (This updated bibliography contains 335 citations, 157 of which are new entries to the previous edition.)

0405 Properties And Composition

REFER ALSO TO CITATION(S) 40248

40260 **(AD-A—098242/1) Parameters affecting the characteristics of oil shale-derived fuels.** (Colorado School of Mines, Golden (USA). Research Inst.). Mar 1981. 149p. NTIS PC A07/MF A01.

Under the terms of the Defense Production Act, it is expected that as the U.S. oil shale industry develops, the Armed Forces of the United States will be the recipients of significant quantities of fuel products derived from shale oil. Lead responsibility for the preparation of fuel specifications for DF-1, DF-2, and DFA fuels has been charged to the U.S. Army, and in order to prepare realistic specifications for these fuels, the Army must be fully aware of all the parameters that will ultimately affect the characteristics of these fuels. The objective of this research program was to collect, review, and evaluate all pertinent information dealing with the parameters that affect the properties of shale-derived fuels. To varying degrees, the critical parameters were found to be the source of the oil shale, method of retorting, retorting conditions, method and degree of upgrading, and refining techniques employed. With all other factors being equal, each of the above parameters will have an effect on the fuel properties; however, the flexibility inherent in the refining step permits all but the most major variations in shale oil properties to be compensated for in this operation. This report describes all of the parameters that are likely to affect the characteristics of shale-derived fuels, with emphasis on the most significant parameters -- retorting and refining.

40261 **(PB—81-190522) The analysis of oil shale wastes: a review. Interim report, April 1979-April 1980.** Wallace, J.R. (Denver Research Inst., CO (USA)). Apr 1981. 298p. NTIS PC A13/MF A01.

This report summarizes the current status of methods for chemical analysis of oil shale effluents. It focuses on inadequacies in standard methods, adapted to oil shale analyses, particularly addressing needs of chemists, engineers, and biologists attempting to select an analytical scheme suitable for oil shale waste, including: sampling, analysis and quality assurance. Especially for the methods of questionable validity, the literature has been searched extensively so that alternate techniques could be included.

0406 Direct Uses And By-products

REFER ALSO TO CITATION(S) 40258

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 40258

40262 **(PB—81-187288) Assessment of oil shale retort wastewater treatment and control technology: phases I and II. Final report, May 1979-March 1980.** Klieve, J.R.; Rawlinss, G.D.; Hoeflein, J.R. (Monsanto Research Corp., Dayton, OH (USA)). Apr 1981. 100p. NTIS PC A05/MF A01.

Oil shale retorting is a synthetic fuel production technology on the verge of commercialization in the United States. In order to ensure that the emerging oil shale industry will have minimal adverse effects upon surface and/or groundwater where recoverable reserves of oil shale are found, demonstrated technologies to upgrade oil shale wastewaters must be available to developers. To this end, the U.S. Environmental Protection Agency has contracted with Monsanto Research Corporation to conduct a three-year, five-phase study to: (1) summarize known information concerning oil shale retort wastewater sources and characteristics; (2) identify potentially applicable control technologies capable of treating the identified wastewater streams; and (3) design, construct, and operate pilot-plant facilities to evaluate the selected technologies. This report presents results of Phases I and II, in which literature and other information sources were surveyed to obtain relevant data about oil shale retorting technologies, wastewater sources and characteristics, potential wastewater uses, and potentially applicable treatment technologies. As a result of the study, data gaps were identified, and recommendations for bench-scale treatability studies were made.

40263 **(PB—81-196602) Environmental perspective on the emerging oil shale industry. Volume 2. Appendices.** (Jacobs Engineering Group, Inc., Pasadena, CA (USA)). Apr 1981. 442p. NTIS, PC A19/MF A01.

This report contains the following appendices: Status and development of the oil shale industry; Procedures for ambient air monitoring; Environmental monitoring activities--past, present and proposed; Applicable Federal, state and local legislation, standards and regulations; Quality assurance bibliography; Federal and state permits required for operation of an oil shale facility.

05 NUCLEAR FUELS

0501 Reserves

REFER ALSO TO CITATION(S) 40653

0502 Exploration

REFER ALSO TO CITATION(S) 41216

0503 Mining

REFER ALSO TO CITATION(S) 40653

40264 **(PB—81-805517) Uranium mining and milling environmental studies. 1964-March, 1981 (citations from the NTIS data base). Report for 1964-March 1981.** (National Technical Information Service, Springfield, VA (USA)). Apr 1981. 308p. NTIS PC N01/MF N01.

Pollution, public and occupational health, and waste management associated with uranium ore recovery and processing are cited. The monitoring and control of contamination in air and effluents in the mining vicinities are discussed in this collection of Federally-funded research. (This updated bibliography contains 299 citations, 57 of which are new entries to the previous edition.)

0504 Feed Processing

40265 **Cesium-uranium-oxygen chemistry in uranium-plutonium oxide fast reactor fuel pins.** Fee, D.C.; Johnson, C.E. (Argonne National Lab., IL (USA). Chemical Engineering Div.). *Journal of Nuclear Materials;* **99**: No. 1, 107-116(Jul 1981).

The Cs-U-O system has been reinvestigated in light of recently reported thermodynamic data for $Cs_2U_4O_{12}$ and recent phase data showing the existence of a new Cs-U-O- compound with an O/(U + Cs) atom ratio less than that of Cs_2UO_4. Our experiments have confirmed the existence of a new phase, allowed the formula $Cs_2UO_{3.56}$ to be assigned, and generated thermodynamic data for this new compound. This new phase exists only at oxygen potentials that are too negative to be encountered in uranium-plutonium oxide fast reactor fuel pins. The compound Cs_2UO_4 appears to be the most likely one to be formed, with the formation occurring at the fuel-blanket interface.

0505 Enrichment

40266 **Laser separation of uranium chosen for scaleup.** Rawls, R.L. *Chemical and Engineering News;* **60**: No. 20, 30-31(17 May 1982).

Atomic vapor laser isotope separation (AVLIS) has been selected by the Department of Energy to go into large-scale engineering development and demonstration over two other advanced

technologies, molecular laser isotope separation and plasma separation. DOE will continue to support development of another uranium enrichment technology, gas centrifugation. By or around 1990, the most promising gas centrifuge technique will be compared to the further developed AVLIS process, and a selection will be made between the two to replace the current technology, gaseous diffusion. The AVLIS process, plasma separation, and molecular laser isotope separation use the selective absorption of radiation of a particular energy level by the ^{235}U isotope. The plasma separation process selectively energizes ^{235}U by ion cyclotron resonance. The AVLIS and molecular laser isotope separation processes both use a carefully tuned laser to excite ^{235}U isotope selectively. In the AVLIS process, uranium metal feed material is melted and vaporized to from an atomic uranium vapor stream. When this vapor stream passes through the beam of copper vapor lasers, the ^{235}U atoms absorb the light and become ionized. These ionized atoms are collected by electromagnetic fields while the neutral ^{238}U atoms pass through the magnetic field and are collected as tailings. The AVLIS process has the potential for significantly reducing the cost of enriching uranium. The status of development, cost, advantages and drawbacks of the five processes (gaseous diffusion, gas centrifugation, AVLIS, molecular laser separation, plasma separation) are discussed. (ATT)

40267 **Method for the separation of uranium isotopes.** Auerbach, A. US Patent Application 206,403. Filed date 3 Nov 1980. 11p.

A method for the separation of uranium isotopes, particularly U235 is disclosed. The method employs a frequency selective laser irradiation of an adiabatically cooled beam of UF6 molecules, followed by the 'chemionization' i.e., SbF5 + UF6 SbF6(-) + UF5(+) of the selectively irradiated UF6 molecules, and finally separates the favored U235F5(+) product.

0506 By-products

40268 **(AD-A—098039/1) Blast pressures induced by the impact of kinetic energy penetrators on steel targets in an enclosed range. Final report.** Bertrand, B.P.; Peterson, R.L.; Dunbar, S.A.; Abrahams, R.R. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). Feb 1981. 43p. (ARBRL-MR—03074). NTIS PC A03/MF A01.

The impact of a kinetic energy penetrator on a steel target in an enclosure produces high temperature fragments that in turn heat the surrounding air, causing the air pressure to rise. Additionally, pyrophoric penetrators like those made of depleted uranium burn rapidly, causing a further increase in air pressure. This report documents and analyzes the pressures measured during tests in which laboratory tungsten and depleted uranium kinetic energy penetrators impacted steel targets inside of an enclosed test range, and compares them with pressures measured during tests using pentolite in the same enclosure.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 40326, 41175

40269 **(DP—1605) Thoria-fuel irradiation. Program to irradiate 80% ThO_2/20% UO_2 ceramic pellets at the Savannah River Plant.** Pickett, J.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Feb 1982. Contract AC09-76SR00001. 29p. NTIS, PC A03/MF A01. Order Number DE82008955.

This report describes the fabrication of proliferation-resistant thorium oxide/uranium oxide ceramic fuel pellets and preparations at the Savannah River Laboratory (SRL) to irradiate those materials. The materials were fabricated in order to study head end process steps (decladding, tritium removal, and dissolution) which would be required for an irradiated proliferation-resistant thorium based fuel. The thorium based materials were also to be studied to determine their ability to withstand average commercial light water reactor (LWR) irradiation conditions. This program was a portion of the Thorium Fuel Cycle Technology (TFCT) Program, and was coordinated by the Oak Ridge National Laboratory (ORNL) under the Consolidated Fuel Reprocessing Program (CFRP). The fuel materials were to be irradiated in a Savannah River Plant (SRP) reactor at conditions simulating the heat ratings and burnup of a commercial LWR. The program was terminated due to a de-emphasis of the TFCT Program, following completion of the fabrication of the fuel and the modified assemblies which were to be used in the SRP reactor. The reactor grade ceramic pellets were fabricated for SRL by Battelle, Pacific Northwest Laboratories. Five fuel types were prepared: 100% UO_2 pellets (control); 80% ThO_2/20% UO_2 pellets; approximately 80% ThO_2/20% UO_2 + 0.25 CaO (dissolution aid) pellets; 100% UO_2 hybrid pellets (prepared from sol-gel microspheres); and 100% ThO_2 pellets (control). All of the fuel materials were transferred to SRL from PNL and were stored pending a subsequent reactivation of the TFCT Programs.

40270 **(PB—82-105354) SASSET: attribute verification of accountancy records in nuclear safeguards. part II: computer code manual.** Mueler, K.H.; Singh, D. (Commission of the European Communities, Luxembourg). 1980. 73p. NTIS PC E04/MF E04.

A procedural description of the SASSET code to be followed during the statistical verification of accountancy records of a nuclear fuel fabrication plant is given. The use of stratified inventory data has achieved a significant decrease in inspection effort. Primary strata are defined on the basis of sampling convenience. Further stratification takes place automatically if it is found that a primary stratum is not homogeneous. After a sample size for each stratum has been chosen, the SASSET code is used to determine the entry lines. A measure of the effectiveness of a particular sampling technique on a particular stratum can be obtained by simulating material removal by a divertor.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 40319

40271 **(CONF-820234—1) Consolidated fuel reprocessing program. Developments for the future in reprocessing.** Burch, W.D. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 3p. NTIS, PC A02/MF A01. Order Number DE82008807.

From WATTec energy conference and exhibition; Knoxville, TN, USA (24 Feb 1982).

The future reprocessing developments focus on three major areas: (1) the retention of gaseous fission products to reduce off-site doses to very low values; (2) the initial steps of breakdown, shearing, and dissolution of breeder fuels; and (3) advanced facility and equipment concepts, which are expected to lead to a reliable, cost-effective, totally remotely operated and maintained plant. Work in the first area - removal of fission gases (the most important of which is ^{85}Kr) - is largely completed through tracer and bench-scale engineering equipment. Efforts are now mainly devoted to breeder fuels and advanced remote concepts. A facility, the Integrated Equipment Test Facility, which will be used to carry out much of this work, is nearing completion in Oak Ridge. In it a large, simulated, remote reprocessing cell will house a disassembly-shear machine for either breeder or LWR fuels, a rotary continuous dissolver, a solvent extraction cycle utilizing a new generation of centrifugal contactors, and related equipment.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 40292, 40297, 40303

40272 **(NUREG—0725-REV-1) Public information circular for shipments of irradiated reactor fuel. Regulatory report 16 Jul 79-1 Jul 81.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Jul 1981. 87p. NTIS, PC A05.

This publication is the second in a proposed series of semiannual publications issued by the Nuclear Regulatory Commission in response to public information requests regarding the Commission's regulation of shipments of irradiated reactor fuel. Subsequent issues in this series will update the information contained herein. This

publication contains basically three kinds of information. (1) Routes approved by the Commission for the shipment of irradiated reactor fuel, (2) Information regarding any safeguards-significant incidents which have been reported to occur during shipments along such routes, and (3) Cumulative amounts of material shipped.

40273 (NUREG—0923) Advance notification of shipments of nuclear waste and spent fuel: guidance. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards). Jun 1982. 17p. GPO, $2.50.

US Nuclear Regulatory Commission regulations in 10 CFR 70.5b and 73.37(f) require NRC licensees to notify the governor of a state prior to making a shipment of nuclear waste or spent fuel within or through the state. This guidance was prepared to assist licensees in carrying out those requirements.

40274 (NUREG/CR—2035) Transportation of radioactive material in Illinois. Transportation surveillance study, 6 Jun 79-6 Jun 80. (Illinois Dept. of Public Health, Springfield (USA)). Apr 1981. 63p. NTIS, PC A04/MF A01.

The report describes the third-year study, covering the period from June 6, 1979 to June 6, 1980, conducted by the State of Illinois, under NRC/DOT contract, to monitor radioactive material in surface transport within the State. Sixteen (16) Illinois State Police troopers, especially trained in dealing with hazardous materials, radiation detection instrumentation, and pertinent Federal and State regulations, served as investigators and inspectors for this surveillance program. The data in this report consist of the information supplied by the State troopers.

40275 (PB—82-800335) Hazardous materials transportation: radioactive materials and wastes. 1964-september, 1981 (citations from the NTIS Data Base). Report for 1964-Sep 81. (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 257p. NTIS PC N01/MF N01.

The bibliography cites studies on the hazards, risks, and uncertainty of transporting radioactive wastes and materials. The design of shipping containers and special labels for identification purposes for transporting fuels and wastes are also cited. Studies are included on legislation dealing with the safety and health of the population and the environmental problems associated with transporting radioactive materials. (This updated bibliography contains 250 citations, 55 of which are new entries to the previous edition.)

40276 (SAND—82-0517C) Impacts of nuclear material flows on transportation routing alternatives. Cashwell, J.W.; Joy, D.S.; McGuire, S.C. (Sandia National Labs., Albuquerque, NM (USA); Oak Ridge National Lab., TN (USA)). 1982. Contract AC04-76DP00789. 9p. (CONF-820303—13). NTIS, PC A02/MF A01. Order Number DE82011470.

From Waste management conference; Tucson, AZ, USA (8 Mar 1982).

The illustration of material flows along a transportation network provides DOE program sponsors with a new method of communicating the potential impacts of various waste management scenarios. While the method combines the outputs of other tools utilized to evaluate system impacts, it also must be utilized with an appropriate amount of caution. Routes projected by the HIGHWAY and INTERLINE models are mathematical simulations of carrier transport and are not intended to explicitly define the actual routes. Determination of the actual routes will depend upon facility operational constraints such as construction, road conditions, weather, and constraints imposed by federal, state and local governments. Routes will thus be selected at the time the shipment is being scheduled by the shipper and carrier. Within the limitations of the available input data, the flow density diagrams graphically depict possible traffic impacts for a given scenario. This information allows identification of affected states or regions and can provide an assessment of the relative influence of this traffic upon the highway and railway networks.

0520 Waste Management

REFER ALSO TO CITATION(S) 40310, 40312, 40316, 40317, 40322, 40727, 40765, 41121, 41145, 41160, 41224, 41426, 41445, 41724, 41727, 41730, 41731, 41733

40277 (CONF-820303—23) Processing capabilties for the elimination of contaminated metal scrapyards at DOE/ORO-managed sites. Mack, J.E.; Williams, L.C. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE82008830.

From Waste management conference; Tucson, AZ, USA (8 Mar 1982).

Capabilities exist for reducing all the contaminated nickel, aluminum, and copper scrap to ingot form by smelting. Processing these metals at existing facilities could be completed in about 5 or 6 years. However, these metals represent only about 20% of the total metal inventories currently on hand at the DOE/ORO-managed sites. No provisions have been made for the ferrous scrap. Most of the ferrous scrap is unclassified and does not require secured storage. Also, the potential resale value of the ferrous scrap at about $100 per ton is very low in comparison. Consequently, this scrap has been allowed to accumulate. With several modifications and equipment additions, the induction melter at PGDP could begin processing ferrous scrap after its commitment to nickel and aluminum. The PGDP smelter is a retrofit installation, and annual throughput capabilities are limited. Processing of the existing ferrous scrap inventories would not be completed until the FY 1995-2000 time frame. An alternative proposal has been the installation of induction melters at the other two enrichment facilities. Conceptual design of a generic metal smelting facility is under way. The design study includes capital and operating costs for scrap preparation through ingot storage at an annual throughput of 10,000 tons per year. Facility design includes an induction melter with the capability of melting both ferrous and nonferrous metals. After three years of operation with scrapyard feed, the smelter would have excess capacity to support on-site decontamination and decomissioning projects or upgrading programs. The metal smelting facility has been proposed for FY 1984 line item funding with start-up operations in FY 1986.

40278 (DP—1589) Rheological properties of kaolin and chemically simulated waste. Selby, C.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Dec 1981. Contract AC09-76SR00001. 37p. NTIS, PC A03/MF A01. Order Number DE82008954.

The Savannah River Laboratory is conducting tests to determine the best operating conditions of pumps used to transfer insoluble radioactive sludges from old to new waste tanks. Because it is not feasible to conduct these tests with real or chemically simulated sludges, kaolin clay is being used as a stand-in for the solid waste. The rheology tests described herein were conducted to determine whether the properties of kaolin were sufficiently similar to those of real sludge to permit meaningful pump tests. The rheology study showed that kaolin can be substituted for real waste to accurately determine pump performance. Once adequately sheared, kaolin properties were found to remain constant. Test results determined that kaolin should not be allowed to settle more than two weeks between pump tests. Water or supernate from the waste tanks can be used to dilute sludge on an equal volume basis because they identically affect the rheological properties of sludge. It was further found that the fluid properties of kaolin and waste are insensitive to temperature.

40279 (DP-MS—81-57) National long-term high-level waste-technology program. Gray, P.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 12p. (CONF-811103—120). NTIS, PC A02/MF A01. Order Number DE82008186.

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

The national program for long-term management of high-level waste (HLW) from nuclear fuels reprocessing is discussed. This covers only DOE defense wastes. Current emphasis is on solidification of waste into a form that, along with additional barriers,

may be permanently stored in a repository. An integrated national plan incorporates all the elements of such an overall HLW disposal system. Interim storage is in near-surface tanks at the Hanford and Savannah River sites. At the Idaho site, waste is stored in bins after being calcined. Some Idaho waste is liquid and is also stored in tanks before calcination. Retrieval and immobilization of HLW into a solid, low-release form represent the major elements for which our long-term program has responsibility. Once solidified, the waste will temporarily remain onsite until the final disposal site is prepared for receipt of waste. Transportation, if necessary, to the ultimate disposal site is the responsibility of the Transportation Technology Center at Sandia National Laboratory. Disposal in a location remote from the human environment is the responsibility of the Office of NWTS Integration (ONI) and Office of Nuclear Waste Isolation (ONWI) operated by Battelle Memorial Institute, Columbus, Ohio. Currently, a geologic repository is favored for ultimate disposal, although other possibilities such as seabed, icecap, space, and near-surface disposal are also being considered. The HLW technology portion of the program (which involves immobilizing the HLW) includes (1) development of technology to support a realistic choice of an isolation system for each HLW site, (2) development of the candidate forms and processes with sufficient scale-up to provide design data for full-scale facilities, and (3) construction and operation of these facilities. (ATT)

40280 **(DP-MS—81-92) Disposal of Savannah River Plant waste salt.** Dukes, M.D. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1982. Contract AC09-76SR00001. 11p. (CONF-820303—22). NTIS, PC A02/MF A01. Order Number DE82008917.

From Waste management conference; Tucson, AZ, USA (8 Mar 1982).

Approximately 26-million gallons of soluble low-level waste salts will be produced during solidification of 6-million gallons of high-level defense waste in the proposed Defense Waste Processing Facility (DWPF) at the Savannah River Plant (SRP). Soluble wastes (primarily $NaNO_3$, $NaNO_2$, and NaOH) stored in the waste tanks will be decontaminated by ion exchange and solidified in concrete. The resulting salt-concrete mixture, saltcrete, will be placed in a landfill on the plantsite such that all applicable federal and state disposal criteria are met. Proposed NRC guidelines for the disposal of waste with the radionuclide content of SRP salt would permit shallow land burial. Federal and state rules require that potentially hazardous chemical wastes (mainly nitrate-nitrate salts in the saltcrete) be contained to the degree necessary to meet drinking water standards in the ground water beneath the landfill boundary. This paper describes the proposed saltcrete landfill and tests under way to ensure that the landfill will meet these criteria. The work includes laboratory and field tests of the saltcrete itself, a field test of a one-tenth linear scale model of the entire landfill system, and a numerical model of the system.

40281 **(EMD—82-64) Department of Energy does not plan to use an abandoned salt mine at Lyons, Kansas, for nuclear high-level waste disposal.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 23 Mar 1982. 4p. General Accounting Office, Washington, DC 20548.

DOE's current high-level waste disposal program is aimed at opening an underground repository by the end of this century. The sites under consideration are in the States of Washington, Nevada, Texas, Mississippi, Utah, and Louisiana. Based on many years of tracking and reporting on DOE's high-level nuclear waste isolation program, the Lyons, Kansas salt mine is no longer being considered for high-level nuclear waste disposal. In addition, in recent conversations among officials from DOE, the Nuclear Regulatory Commission, the Kansas State Government, and the Rickano Corporation, it was confirmed that the Lyons mine is not part of the Federal high-level waste program.

40282 **(GAT-S—26) Controlled waste-oil biodegradation at existing drying beds.** Hary, L.F. (Goodyear Atomic Corp., Piketon, OH (USA)). 1982. Contract AC05-76OR00001. 15p. (CONF-820418—6). NTIS, PC A02/MF A01. Order Number DE82011714.

From UCC-ND and GAT environmental protection seminar; Gatlinburg, TN, USA (5 Apr 1982).

A feasibility study at the Portsmouth Uranium Enrichment Facility to determine if sludge drying beds at a sewage treatment plant could be used as controlled waste oil biodegradation plots has been completed. A greenhouse-like enclosure would be constructed over three 9.1 meter by 21.3 meter beds to allow for year-round use, and any waste oil runoff would be collected by existing leachate piping. It has been determined that this proposed facility could dispose of existing radioactive waste oil generation (7200 liters/year) from the Gaseous Diffusion Plant (GDP); however, it would be inadequate to handle radioactive waste oils from the new Gas Centrifuge Enrichment Plant (GCEP) as well. The study reviewed nuclear criticality constraints, biodegradation technology, and the capital cost for an enclosed biodegradation facility.

40283 **(INIS-mf—6783) Proposal for basic safety requirements regarding the disposal of high-level radioactive waste.** (Miljoestyrelsen, Copenhagen (Denmark). Arbejdsgruppe om Radioaktivt Affald). Apr 1980. 64p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82780392.

A working group commissioned to prepare proposals for basic safety requirements for the storage and transport of radioactive waste prepared its report to the Danish Agency of Environmental Protection. The proposals include: radiation protection requirements, requirements concerning the properties of high-level waste units, the geological conditions of the waste disposal location, the supervision of waste disposal areas. The proposed primary requirements for safety evaluation of the disposal of high-level waste in deep geological formations are of a general nature, not being tied to specific assumptions regarding the waste itself, the geological and other conditions at the place of disposal, and the technical methods of disposal. It was impossible to test the proposals for requirements on a working repository. As no country has, to the knowledge of the working group, actually disposed of high-level radioactive waste or approved of plans for such disposal. Methods for evaluating the suitability of geological formations for waste disposal, and background material concerning the preparation of these proposals for basic safety requirements relating to radiation, waste handling and geological conditions are reviewed. Appended to the report is a description of the phases of the fuel cycle that are related to the storage of spent fuel and the disposal of high-level reprocessing waste in a salt formation. It should be noted that the proposals of the working group are not limited to the disposal of reprocessed fuel, but also include the direct disposal of spent fuel as well as disposal in geological formations other than salt. (EG).

40284 **(INIS-mf—6784) Disposal of high-level waste from nuclear power plants in Denmark. Salt dome investigations. V.1. Summary.** (Jysk-Fynske Elsamarbejde (ELSAM), Fredericia (Denmark); ELKRAFT A.m.b.A., Hellerup (Denmark)). 1981. 92p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE82780393.

A summary is presented of a report in five volumes on possible disposal of radioactive waste in Denmark. The investigation was made by the Danish electric utilities ELKRAFT and ELSAM at the request of the Danish Government. The investigation proved it possible to consider two alternative designs for a disposal facility, one based on the deposition of waste in individual, deep holes, the other on placing the waste in mine galleries. A safety analysis was completed with the Mors dome as example. The purpose of the analysis was to prove whether safe disposal of high-level waste in Denmark was feasible. The utilities concluded that the results of the analysis were satisfactory and the report is now being assessed by the authorities. (BP).

40285 **(INIS-mf—6785) Disposal of high-level waste from nuclear power plants in Denmark. Salt dome investigations. V.2. Geology, text.** (Jysk-Fynske Elsamarbejde (ELSAM), Fredericia (Denmark); ELKRAFT A.m.b.A., Hellerup (Denmark)). 1981. 411p. NTIS (US Sales Only), PC A11/MF A01. Order Number DE82780394.

The present report deals with the geological investigations performed for determining the feasibility of a repository for high-level waste in a salt dome. It is volume 2 of five volumes that together constitute the final report of the Danish utilities' salt dome investigations. The purpose of the work was to procure a more de-

tailed knowledge of the geology of salt domes in North Jutland on example of Mors. The Mors dome is oval with the two axes of approx. 12.5 km and 8 km respectively. Two deep wells have been drilled into the salt. These wells reach 3400-3500 m below surface. Until a depth of about 3200 m Erslev 2 passes through rock salt of Zechstein 1 which is the oldest evaporite series. However, it could also be interlayed with the slightly younger Zechstein 2. At about 3200 m a marker layer was met with Zechstein 2 salt below. Interpretation of cores and results of downhole electromagnetic and borehole gravimetric measurements show that there is a large area around Erslev 2 which consists of very pure sodium chloride with traces of anhydrite (calcium, sulphate) 1-3%. This area is used for the repository design and safety evaluation. The hydrological conditions existing in the strata above the salt dome (caprock) have been investigated with the help of four hydrogeological wells, placed two each, on two different sites. The cores themselves were taken at various depths in all four holes. With these laboratory methods it has been possible to measure data relevant to hydrology - such as porosity and permeability - as well as geochemistry. (BP).

40286 **(INIS-mf—6786) Disposal of high-level nuclear waste from nuclear power plants in Denmark. Salt dome investigations. V.2. Geology, figures.** (Jysk-Fynske Elsamarbejde (ELSAM), Fredericia (Denmark); ELKRAFT A.m.b.A., Hellerup (Denmark)). 1981. 109p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE82780395.

This report contains figures relating to the geological investigations described in vol 2 (text) of the report on disposal of high-level waste from nuclear power plants in Denmark.

40287 **(INIS-mf—6787) Disposal of high-level waste from nuclear power plants in Denmark. V.3. Material testing.** (Jysk-Fynske Elsamarbejde (ELSAM), Fredericia (Denmark); ELKRAFT A.m.b.A., Hellerup (Denmark)). 1981. 123p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE82780396.

The present report deals with material testing as part of the investigations regarding a repository for high-level waste in a salt dome. It is volume 3 of five volumes that together constitute the final report of the Danish utilities' salt dome investigations. The material testing programme chiefly comprised laboratory investigations and analyses of material samples, partly obtained from the salt dome in question and partly from the overlying geological formation. The test programme was fully completed for Eslev salt dome on Mors. Chemical analyses and mineralogical investigations were carried out in order to determine the type and extent of the impurities confined in the rock salt. Moreover, a programme was carried out to investigate the water content of the salt. Temperature conditions around a repository, the strenght and creep properties of the salt were investigated in order to determine whether drill holes, shafts and mine galleries could be constructed and maintained intact within the period of time required to complete the disposal of high-level waste. Chemical analysis were carried out in order to determine which substances are found dissolved in the water contained by the geological formation overlying the salt dome, as well as chemical/physical investigations regarding the water content, porosity, velocity of a possible leak of radioactive waste products, etc. Materials that would be introduced into a repository were studied with regard to their corrosion resistance in the salt environment. Concrete materials were investigated and characterized for their use in the final sealing of the access routes to the repository through the geological formation.

40288 **(INIS-mf—6788) Disposal of high-level waste from nuclear power plants in Denmark. Salt dome investigations. V.4. Repository design.** (Jysk-Fynske Elsamarbejde (ELSAM), Fredericia (Denmark); ELKRAFT A.m.b.A., Hellerup (Denmark)). 1981. 80p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE82780397.

The present report deals with construction, operation and sealing of disposal facilities for high-level waste in a salt dome. It is volume 4 of five volumes that together constitute the final report on the Danish utilities' salt dome investigations. The safety investigations were carried out for a deep-hole disposal facility located in the salt dome on Mors. In principle the results of the investigations also apply to a shaft/mine disposal facility. The facility is designed for the disposal of vitrified high-level waste in the shape of glass canisters. There is a low concentration of waste in each canister, approx. 10%. Furthermore, it was selected to place the waste in an intermediate storage for about 40 years prior to its final disposal. Consequently, heat generation in the waste at the time of final disposal will be modest, resulting in low temperature increase in the salt. As an example, the highest temperature increase will be approx. 40 deg. C. and it will occur at the edge of the hole five years after disposal has taken place. Prior to disposal, the glass canisters are encased in steel casks with 15 cm thick walls. Three canisters are placed in each cask, and 215 casks are stacked on top on one another in each deep-hole from a depth of 1200 m to 2500 m underground. The additional encasing is designed to protect the glass from dissolution should any brine reach the disposal facility. Furthermore, the steel cask protects the glass canisters against pressure from the wall of the hole. The technical design of the disposal facility gives it a considerable safety margin against unexpected events. The investigations proved Cretaceous strata to constitute an effective secondary barrier that would prevent radioactive matter from travelling from the underlying disposal facility to the biosphere.

40289 **(INIS-mf—6789) Disposal of high-level waste from nuclear power plants in Denmark. Salt dome investigations. V.5. Safety evaluation.** (Jysk-Fynske Elsamarbejde (ELSAM), Fredericia (Denmark); ELKRAFT A.m.b.A., Hellerup (Denmark)). 1981. 143p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE82780398.

The present report deals with safety evaluation as part of the investigations regarding a repository for high-level waste in a salt dome. It is volume 5 of five volumes that together constitute the final report on the Danish utilities' salt dome investigations. Two characteristics of the waste are of special importance for the safety evaluation: the encasing of the waste in steel casks with 15 cm thick walls affording protection against corrosion, protecting the surroundings against radiation, and protecting the glass cylinders from mechanical damage resulting from the pressure at the bottom of the disposal hole, and the modest generation of heat in the waste at the time of disposal resulting in a maximum temperature increase in the salt close to the waste of approx. 40 deg. C. These characteristics proved to considerably improve the safety margin with respect to unforeseen circumstances. The character of the salt dome and of the salt in the proposed disposal area offers in itself good protection against contact with the ground water outside the dome. The relatively large depth of 1200 and 2500 m of the salt surface also means that neither dome nor disposal facility will be appreciably influenced by glaciations or earthquakes. The chalk above the proposed disposal area is very tight and to retain radioactive matter effectively even in the precence of high concentrations of NaCL. The safety investigations included a number of natural processes and probable events such as the segregation of crystal water from overlooked salt minerals, faulty sealings of disposal holes, permeable fault zones in the chalk overlying the dome, the risk in connection with human penetration into the dome. Leaching of a cavern is the only situation which proved to result in a release of radioactive material to the biosphere, but the resulting doses was found to be small compared to the probability that such a situation should develop.

40290 **(LA—9207-MS) Preliminary identification of interfaces for certification and transfer of TRU waste to WIPP.** Whitty, W.J.; Ostenak, C.A.; Pillay, K.K.S. (Los Alamos National Lab., NM (USA)). Feb 1982. Contract W-7405-ENG-36. 24p. NTIS, PC A02/MF A01. Order Number DE82009081.

This study complements the national program to certify that newly generated and stored, unclassified defense transuranic (TRU) wastes meet the Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria. The objectives of this study were to identify (1) the existing organizational structure at each of the major waste-generating and shipping sites and (2) the necessary interfaces between the waste shippers and WIPP. The interface investigations considered existing waste management organizations at the shipping sites and the proposed WIPP organization. An effort was made to identify the potential waste-certifying authorities and the lines of communi-

cation within these organizations. The long-range goal of this effort is to develop practicable interfaces between waste shippers and WIPP to enable the continued generation, interim storage, and eventual shipment of certified TRU wastes to WIPP. Some specific needs identified in this study include: organizational responsibility for certification procedures and quality assurance (QA) program; simple QA procedures; and specification and standardization of reporting forms and procedures, waste containers, and container labeling, color coding, and code location.

40291 (ONWI—9-81-3, pp 14-34) **Systems.** 1981. NTIS, PC A12/MF A01.

In Technical progress report, 1 April-30 June 1981.

Summaries of quarterly highlights under the task entitled Systems are included in this section. Topics include: socio-economic assessment, systems analysis, alternative disposal concepts, and performance assessment for the permanent isolation of nuclear wastes. A computer model was developed to assist in preparing preliminary estimates of repository costs and the cost impact of design changes. The model uses cost data from numerous detailed architectural and engineering estimates as a basis. Significant progress was made in the laboratory research on the closure of fractures under conditions of high temperature and pressure. New methods of measuring the extent of fracture closure are now being developed. The two-dimensional analytical transport code, UCBNE 25, which predicts radionuclide concentration in steady ground-water flows, was used to predict the far-field migration of radionuclides released from waste packages at WIPP and BWIP. An additional code for radionuclide transport through a fractured rock has been modified to include decay chains. A method was developed which yields physical insight into leach rate trends while minimizing the required mathematical effort. A necessary condition, at this time, is the time-invariance of the parameters used to represent the mechanisms controlling waste form leaching. (DMC)

40292 (ONWI—9-81-3, pp 35-81) **Waste package.** 1981. NTIS, PC A12/MF A01.

In Technical progress report, 1 April-30 June 1981.

Summaries of quarterly highlights under the task entitled Waste Package are presented in this section. These reports consist of studies on performance measures, waste forms, barrier materials, design and stesting of waste packages, and performance evaluation through modeling demonstration testing, and natural experiments. A study on spent fuel disassembly alternatives is under way to assess the impacts of five alternative spent fuel waste forms for geologic disposal and to recommend the reference form. After assessments were made on technical, operating, safety, and economic bases, the results, when used with the figure-of-merit methodology developed at the initiation of the studies, resulted in the option of disassembly and close packing as the reference disposal waste form. Preparations continued for the shipment of the glass HLW log to NTS/EMAD. All of the cask-handling and shipping hardware has been fabricated and accepted. The cask-handling procedure is completed and approved. Phase stability studies in waste form and material studies continue to focus on the structural integrity of ceramic waste forms. Several ceramic samples of cesium hollandite and potassium hollandite were produced; their densities of 80 to 90 percent of theoretical value are favorable for evaluating the transport of cesium ions in these types of structures. For gas-liquid inclusions, the development of numerical algorithms for the spherical liquid inclusion with a centrally positioned spherical gas bubble is complete for the decoupled temperature effects. (DMC)

40293 (ONWI—9-81-3, pp 82-144) **Site.** 1981. NTIS, PC A12/MF A01.

In Technical progress report, 1 April-30 June 1981.

Summaries of quarterly highlights under the task entitled Site, are presented in this section. These reports deal with the earth sciences of geophysics, geochemistry, and transport properties, and with geologic, hydrologic, and environmental characterization of sites that provide natural barriers in salt, granite, and shale. In the Permian Basin, portions of the study area meeting preliminary screening specifications were identified and recommended for further investigation. The Texas Bureau of Economic Geology completed detailed stratigraphic cross sections of the Upper Permian, Triassic, and Tertiary strata in the Palo Duro Basin. The salt dome site characterization planning effort centered on meetings in Texas, Louisiana, and Mississippi to discuss the key issues of concern. In the Paradox Basin, primary effort was directed toward preparing the five-volume area characterization report, laboratory analysis of core samples from the Salt Valley and Gibson Dome boreholes, and re-entry of the existing Kubat hole. Work is being conducted in the Lake Superior region to identify potentially suitable intrusions through a study of existing literature. Pacific Northwest Laboratory continued gathering baseline environmental data in the Northeast region. Meetings were held with Argonne National Laboratory (performing the Northeast geologic characterization), wherein agreement was reached on the boundaries of the study region.Oak Ridge National Laboratory completed gathering about 95 percent of the required environmental baseline data for the Southeast region. Laboratory observations of diagenetic alterations of the Conasauga shale suggest that in a HLW repository in shale, the increased temperature may cause the crystallization of chlorite, quartz, and/or calcite in the small tension fracture caused by the excavation, producing a self-healing process that will decrease fracture porosity and permeability. (DMC)

40294 (ONWI—9-81-3, pp 145-245) **Repository.** 1981. NTIS, PC A12/MF A01.

In Technical progress report, 1 April-30 June 1981.

Summaries of quarterly highlights under the task entitled Repository are presented in this section. The repository reports involve studies to build a data base; equipment, instrument, and seal development; repository engineering and conceptual design; and performance evaluation. The salt model pillar studies project tested a series of model pillars under temperature and pressure conditions that would be expected in an actual disposal operation. The results indicate that for each sample there is a high rate of deformation that decreases with time. This decrease in deformation rates is shown to continue to 600 hours. The convective heat transfer in room and pillar geometries project made significant progress in obtaining a correlation for fully developed Nusselt numbers in a rectangular duct with aspect ratio 1.0. Reynolds numbers ranged from 98,300 to 32,000. The main activity of the analysis of flow-through fractured crystalline rock project was to develop the basic statistical parameters needed to characterize the fracture system at Stripa. In the project on rock behavior under elevated pressure and temperature, calibration of the thermal conductivity measurement was achieved with the completion of the run on the reference standard of GE 124 fused silica. A draft report on numerical simulations of earthquake effects on tunnels for generic nuclear waste repositories, by Science Applications, was completed. The objectives of this generic study are to use numerical modeling techniques to determine under what conditions seismic waves generated by an earthquake might cause instability to an underground opening,or cause fracturing and joint movement that would lead to an increase in the permeability of the rock mass. In repository sealing work, the results from the plug flow test have been analyzed and are in good agreement with the results obtained from the Bell Canyon borehole plug test.

40295 (ONWI—9-81-3, pp 247-250) **Test facilities and excavations.** 1981. NTIS, PC A12/MF A01.

In Technical progress report, 1 April-30 June 1981.

Summaries of quarterly highlights under the task entitled Test Facilities and Excavations are presented in this section. This area is concerned with facilities in both salt and alternative media which will eventually be used for laboratory and in situ testing of the relationships among the package, repository, and site. In the alternative geology test facility mine screening project, computer programs for screening and ranking were completed. A list of 66 mines meeting the general identification criteria was developed. The screened data base was supplemented by additional data from various sources. (DMC)

40296 **(ONWI—321) Radionuclide migration/retardation: research and development technology status report.** Moody, J.B. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Mar 1982. Contract AC06-76RL01830. 65p. NTIS, PC A04/MF A01. Order Number DE82008448.

This report describes the details of migration/retardation processes. These details must be addressed in order to predict, with

some degree of accuracy, whether potentially toxic radionuclides transported by ground water can be effectively isolated from the biosphere by the engineered barriers of a waste package, the repository, and the natural barriers provided by the rock itself (salt, basalt, tuff, or granite). Radionuclides of greatest concern include: technetium, plutonium, neptunium, iodine, uranium, cesium, radium, and strontium. The present knowledge of groundwater hydrology as it pertains to site selection and waste isolation has been reviewed. An evaluation of glass and alternate waste form stability is described. A discussion is presented on radionuclie chemistry in geologic environments including aqueous speciation, precipitation, sorption, solid-solution behavior, in-situ measurements, geochemical models, and natural analogs. A performance analysis of various models is also included. 111 references. (DMC)

40297 **(PB—81-196966) Nonproliferation and spent fuel disposal policy. Final report.** Chow, B.G.; Jones, G.S. (Pan Heuristics, Marina del Ray, CA (USA)). 29 Oct 1980. 39p. NTIS, PC A03/MF A01.

In order to reconcile the need for progress in nuclear waste management with the suspension of commercial reprocessing, this study recommends that spent fuel be placed in temporary storage for 20 years and then permanently disposed of. Such a scheme would always retain in retrievable storage a sufficient amount of plutonium for breeder R and D and commercialization programs using optimistic schedules for breeder deployment in the U.S. and Japan. The amount of fissile material in the permanently disposed of spent fuel would rise from 5 percent of cumulative uranium requirements in 2000 to a maximum of only 15 percent after 2025. These marginal losses of fissile material would be outweighed by lesser reprocessing costs and proliferation risks, not to mention progress in waste management. The study also recommends that the RDandD program on sub-seabed disposal be assigned a priority equal to that of the land-based program, in light of the possibility of an unfavorable political climate surrounding sites for the latter.

40298 **(PB—81-855975) Zeolites in radioactive applications. January 1970-November 1980 (citations from the NTIS Data Base). Report for January 1970-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 59p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the applications of zeolites as ion exchangers for radioactive waste processing, disposal, and storage. Properties and performance of zeolites in these applications are discussed in general and for specific radioactive materials and for specific geographic locations and facilities. (Contains 45 citations, fully indexed and including a table of contents.)

40299 **(PB—81-855983) Zeolites in radioactive applications. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 92p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the applications of zeolites as ion exchangers for radioactive waste processing, disposal, and storage. Properties and performance of zeolites in these applications are discussed in general and for specific radioactive materials as well as for specific geographic locations and facilities. (Contains 75 citations, fully indexed and including a table of contents.)

40300 **(PNL—4098) Development and testing of matrices for the encapsulation of glass and ceramic nuclear waste forms.** Wald, J.W.; Brite, D.W.; Gurwell, W.E.; Buckwalter, C.Q.; Bunnell, L.R.; Gray, W.J.; Blair, H.T.; Rusin, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1982. Contract AC06-76RL01830. 116p. NTIS, PC A06/MF A01. Order Number DE82008774.

This report details the results of research on the matrix encapsulation of high level wastes at PML over the past few years. The demonstrations and tests described were designed to illustrate how the waste materials are effected when encapsulated in an inert matrix. Candidate materials evaluated for potential use as matrices for encapslation of pelletized ceramics or glass marbles were categorized into four groups: metals, glasses, ceramics, and graphite. Two processing techniques, casting and hot pressing, were investigated as the most promising methods of formation or densification of the matrices. The major results reported deal with the development aspects. However, chemical durability tests (leach tests) of the matrix materials themselves and matrix-waste form composites are also reported. Matrix waste forms can provide a low porosity, waste-free barrier resulting in increased leach protection, higher impact strength and improved thermal conductivity compared to unencapsulated glass or ceramic waste materials. Glass marbles encapsulated in a lead matrix offer the most significant improvement in waste form stability of all combinations evaluated. This form represents a readily demonstrable process that provides high thermal conductivity, mechanical shock resistance, radiation shielding and increased chemical durability through both a chemical passivation mechanism and as a physical barrier. Other durable matrix waste forms evaluated, applicable primarily to ceramic pellets, involved hot-pressed titanium or TiO_2 materials. In the processing of these forms, near 100% dense matrices were obtained. The matrix materials had excellent compatibility with the waste materials and superior potential chemical durability. Cracking of the hot-pressed ceramic matrix forms, in general, prevented the realization of their optimum properties.

40301 **(RI—124) Thermal conductivity and penetrability of rocks as a medium for radioactive waste disposal.** Rogozin, Yu.M.; Zakharenkov, V.F.; Bryzgalov, R.V. (Radievyj Inst., Leningrad (USSR)). 1980. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700736.

Some properties of rocks promising for the selection of a medium for disposal of solidified radioactive wastes are considered. The results of laboratory investigations on filterability, the open porosity values, penetrability coefficients, coefficient of salt solution rates are presented. The diffusion of radionuclides from the vitrified wastes into salt rocks is evaluated. It follows from the data obtained that the maximum possible spread of radioactive isotopes in salt rocks for diffusion account cannot exceed some tens of meters even for 3000 years. Therefore under the absence of underground waters circulation in rocks, rock salt can provide reliable insulation of radioactive wastes for a long period of time.

40302 **(SAND—79-0406C) Near-field interactions.** Krumhansl, J.L.; McVey, D.F. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1979. Contract AC04-76DP00789. 12p. NTIS, PC A02/MF A01. Order Number DE82011303.

To approach the subject of high level nuclear waste disposal in deep ocean sediments it is convenient to differentiate between processes occurring in a near field environment, that region arbitrarily defined as lying between the canister surface and the maximum extent of the 100°C isotherm, and those which occur at lower temperatures and beyond the influence of intense radiation. A variety of considerations related to the chemistry of seawater-sediment mixtures suggests that about 200°C is the maximum temperature advisable in the near field environment. Results of a coupled fluid flow - thermal transport computer model show the maximum convection rate adjacent to a canister having surface temperature of 200°C is 0.3 m/100 years, and that this velocity is halved with the passage of each thermal half life of the assumed waste form (30 years). Based on this convective model, it follows that compounds formed in the near field environment during the first thousand years following emplacement would be restricted to a region lying within two meters of the canister surface.

40303 **(SAND—80-2639) Thermal analysis of nuclear waste emplacement in welded tuff.** Langkopf, B.S. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1981. Contract AC04-76DP00789. 38p. NTIS, PC A03/MF A01. Order Number DE82009353.

Welded tuff is being evaluated as a possible medium in which to store nuclear waste. This report analyzes the heat effects of emplacing radioactive waste in welded tuff below the water table at Yucca Mountain on the Nevada Test Site (NTS). One-, two-, and three-dimensional calculations were used to evaluate the heat effects of spent fuel (SF) and commercial high-level waste (CHLW) in three regions: the very-near field, the room and pillar,

and the far field. It was assumed that the canistered waste was placed in a borehole with no additional waste packaging. As a result of the calculations, interim reference-repository conditions of a gross thermal loading (GTL) of 100 kW/acre and a 20% extraction ratio (ER) were defined for both SF and CHLW. For these conditions, far-field temperatures remain below 100°C and those in the room-and-pillar domain below 120°C. In the very-near field, canister centerline temperatures are 195°C for SF and 295°C for CHLW; borehole wall temperatures are 184°C for SF and 222°C for CHLW. (The room-and-pillar and far-field temperatures are recognized as upper limits.) Once a full waste package is defined, canister loading may have to be reduced to prevent excessively high temperature within the waste package.

40304 **(SAND—82-0080) Abridged borehole histories for the Waste Isolation Pilot Plant (WIPP) studies.** Seward, P.D. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1982. Contract AC04-76DP00789. 91p. NTIS, PC A05/MF A01. Order Number DE82009348.

Abridged hole histories for 72 boreholes drilled for the Waste Isolation Pilot Plant (WIPP) project summarize borehole locations, depths, hole conditions, geophysical logs, and observations. The report is a working document and is not interpretive. A map of borehole locations is included.

40305 (SKBF/KBS-SP—81-05, pp 1-28) **Core-logs of borehole VI down to 505 m.** Carlsson, L.; Olsson, T.; Stejskal, V. (Sveriges Geologiska Undersoekning, Stockholm). Jul 1981. NTIS (US Sales Only), PC A03/MF A01.

In STRIPA Project. Pt. 1 and 2.

In the hydrogeological program of the Stripa project the vertical borehole V1 has been drilled 505.5 m. The drillcore has been logged with regard to rock characteristic, fracture frequency, dipping and filling. The results presented as cumulative fracture diagram have formed the base for subdivision of the borehole according to fracture frequency. The variation in the fracture dipping was also taken into account. Chlorite is the most common of the infilling material in the fractures. For the borehole 0-466 m the average fracture frequency is 1.46 fractures/m. Below 466 m the core is highly fractured and crushed indicating that the borehole has entered a crushed zone. Because of this the drilling is temporarily stopped.

40306 (SKBF/KBS-SP—81-05, pp 1-12) **Measurement of triaxial rock stresses in borehole VI.** Strindell, L.; Andersson, M. (Swedish State Power Board). Jul 1981. NTIS (US Sales Only), PC A03/MF A01.

In STRIPA Project. Pt. 1 and 2.

One of the tasks within the Stripa project is to drill a vertical hole with a diameter of 76 mm to 1050 meters depth. The drilling is performed from a place in the mine at about 360 m below ground level. Hydrologic investigations will be performed in the borehole and knowledge about the existing rock pressure will aid the intepretation of the hydrology data. The intention was to perform 4 measurements at depths of 150, 300 and 450 m respectively. At present measurements have been carried out at 150 and 300 m depth. At 450 m the quality of the rock was too poor to allow any measurements.

40307 **(UCRL—53201) Fracture mapping at the Spent Fuel Test-Climax.** Wilder, D.G.; Yow, J.L. Jr. (Lawrence Livermore National Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 55p. NTIS, PC A04/MF A01. Order Number DE82009073.

Mapping of geologic discontinuities has been done in several phases at the Spent Fuel Test-Climax (SFT-C) in the granitic Climax stock at the Nevada Test Site. Mapping was carried out in the tail drift, access drift, canister drift, heater drifts, instrumentation alcove, and receiving room. The fractures mapped as intersecting a horizontal datum in the canister and heater drifts are shown on one figure. Fracture sketch maps have been compiled as additional figures. Geologic mapping efforts were scheduled around and significantly impacted by the excavation and construction schedules. Several people were involved in the mapping, and over 2500 geologic discontinuities were mapped, including joints, shears, and faults. Some variance between individuals' mapping efforts was noticed, and the effects of various magnetic influences upon a compass were examined. The examination of compass errors improved the credibility of the data. The compass analysis work is explained in Appendix A. Analysis of the fracture data will be presented in a future report.

40308 **(UCRL—53227) Excavation and drilling at a spent-fuel test facility in granitic rock.** Patrick, W.C.; Mayr, M.C. (Lawrence Livermore National Lab., CA (USA)). Oct 1981. Contract W-7405-ENG-48. 50p. NTIS, PC A03/MF A01. Order Number DE82009041.

Funding for a project to test the feasibility of safe and reliable storage and retrieval of spent fuel from a commercial nuclear reactor was approved by the Department of Energy on June 2, 1978. By May 28, 1980, 11 spent-fuel assemblies had been emplaced 420 m below the surface in the Climax granitic stock at the Nevada Test Site. Design and construction of the Spent Fuel Test-Climax, including fuel emplacement, had taken less than two years, at a total cost of $18.4 million. Construction activities were preceded by geologic exploration using four cored holes and existing underground workings. The sinking of a 0.76-m-diam shaft to the 420-m level initiated construction at the site. Effective rates of sinking varied from 0.16 m/h with a rotary tricone drill to 0.5 m/h with a hammer drill. Underground excavation included a central canister-storage drift 4.6 x 6.1 x 64 m long, two parallel 3.4 x 3.4-m heater drifts, and a tail drift. About 6700 m^3 were excavated at an average rate of 2 m^3/h, and 178 cored holes, with diameters from 38 to 152 mm, were drilled. A total length of nearly 1100 m was drilled at rates ranging from 0.4 m/h to 1 m/h, depending on hole size and drilling equipment. Eighteen 610-mm-diam canister emplacement holes were hammer-drilled at an average rate of 1.4 m/h. The use of the critical path method, integrated contractors, and close cooperation between project participants facilitated completion of the project on schedule.

40309 **(UJV—5734-Ch) Phosphate system as medium for radioactive waste fixation. Simplex experiment. Part I.** Santarova, M.; Vojtech, O.; Suessmilch, J.; Stejskal, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Jun 1981. 16p. (In Czech). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700735.

Results are reported of laboratory experiments with solidification of HLW using polyphosphates as a matrix. Before heat treatment, phosphoric acid and ferric nitrate were used as the only two admixtures to HLW solution. Physico-chemical properties of the final solidification products were measured; corresponding data characterizing the heat treatment were also obtained. The preparation of solidification products and the results of hydrolytic resistance measurements are dealt with in detail. The present study serves as a basis for future pilot plant experiments.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 40264, 40315, 41415, 41426, 41445

40310 **(ENPU—80-7) Distribution coefficient (Kd) concept and its applicability to studies of radionuclide migration in geological media.** McKinley, I.G.; Greenwood, P.B. (Institute of Geological Sciences, Harwell (UK). Environmental Protection Unit). Apr 1980. 21p. Environmental Protection Unit, Institure of Geological Sciences, Building 151, Harwell Laboratory, Oxfordshire OX11 ORA, England.

In this report the background of the IGS radionuclide migration project is described and the results of preliminary sorption studies reported. In particular, the limitations of the distribution coefficient (Kd) concept is discussed and illustrated for a degraded granite/groundwater system spiked with ^{137}Cs, ^{90}Sr and ^{139}Ce. Proposed developments of this project and future research aims are described.

40311 **(NUREG/CR—2637) Emergency response capabilities and example assessments for airborne radionuclide discharges.** Start, G.E.; Cate, J.H.; Ackermann, G.R.; Dickson, C.R. (National Oceanic and Atmospheric Administration, Idaho Falls, ID (USA). Air Resources Lab.). May 1982. 29p. GPO $2.75.

An existing emergency response capability has been developed for the Idaho National Engineering Laboaratory by NOAA Air Resources Laboratories Field Research Office. The system consists of several existing computers and associated data collection facilities. This equipment has been coordinated into a useful capability providing initial and ongoing analysis of meteorological and radiological information. In the event of a radiological emergency, this information may be used to assist action plan formulations and decisions for the area in and around the Snake River Plain in Southeast Idaho.

40312 **(PB—81-203366) Permeability of covers over low-level radioactive-waste burial trenches, West Valley, Cattaraugus County, New York. Water resources investigations (final) 1977-78.** Prudic, D.E. (Geological Survey, Albany, NY (USA). Water Resources Div.). Sep 1980. 41p. NTIS, PC A03/MF A01.

Gas pressure in the unsaturated parts of radioactive waste burial trenches responds to fluctuations in atmospheric pressure. Measurements of atmospheric pressure and the differential pressure between the trench gas and the atmosphere on several dates in 1977-78 were used to calculate hydraulic conductivity of the reworked silty-clay till that covers the trenches. Generally the hydraulic conductivity of covers over trenches that had a history of rapidly rising water levels are higher, at least seasonally, than covers over trenches in which the water level remained low. This supports the hypothesis that recharge occurs through the cover, presumably through fractures caused by desiccation and (or) subsidence. Hydraulic conductivities of the cover as calculated from gas- and air-pressure measurements at several trenches were 100 to 1,000 times greater than those calculated from the increase in water levels in the trenches. This difference suggests that the values obtained from the air- and gas-pressure measurements need to be adjusted and at present are not directly usable in ground-water flux calculations. The difference in magnitude of values may be caused by rapidly decreasing hydraulic conductivity during periods of recharge or by the clogging of fractures with sediment washed in by runoff.

40313 **Analyses of uranium and actinium gamma spectra: An application to measurements of environmental contamination.** Momeni, M.H. (Argonne National Lab., IL (USA)). *Nuclear Instruments and Methods in Physics Research;* **193**: No. 1/2, 185-190(15 Feb 1982).

From 5. symposium on x- and gamma-ray sources and applications; Ann Arbor, MI, USA (10 - 12 Jun 1981).

A system for the reduction of the complex gamma spectra of nuclides in the uranium, actinium, and thorium series, tailored to calculation of line intensities, analyses of errors, and identification of nuclides is described. This system provides an efficient technique for characterizing contamination in the environs of uranium mines and mills. Identification of the nuclides and calculation of their concentrations requires accurate knowledge of gamma energies and absolute quantum intensities. For some spectral lines, there are no reported measurements of absolute quantum intensities and in some cases where reports are available the measured intensities are not in agreement. In order to improve this data base, the spectra of gamma rays (of nuclides in the uranium and actinium series) with energies between 40 and 1400 keV were measured using high-resolution germanium detectors. A brief description of the spectroscopy system, computational algorithms for deconvolution, and methods of calibration for energy and efficiency, are described. The measured energies and absolute quantum intensities are compared with those reported in the literature.

40314 **Environmental impact of operations at Los Alamos Scientific Laboratory (LASL).** Moe, C.E. Monticello, IL; Vance Bibliographies (1981). 21p. Vance Bibliographies, Post Office Box 229, Monticello, IL 61856 $3.00.

This bibliography contains citations relevant to the environmental impact of solid radioactive waste disposal at Los Alamos Scientific Laboratory (LASL). (ACR)

0540 Health And Safety

REFER ALSO TO CITATION(S) 40289, 40311, 41563

40315 **(AD-A—103954/4) Sensitivity study on air dispersion and hazard exposure models.** Bucci, S.A.; Nalbandian, J.Y. (Analytic Sciences Corp., Reading, MA (USA)). Apr 1981. Contract DAAK10-80-C-0108. 44p. NTIS, PC A03/MF A01.

The U.S. Army is currently using mathematical models to assess potential hazards associated with the use of depleted uranium (DU) munitions. These models simulate dispersion of material released to the air, determine subsequent air and ground concentrations, and estimate potential radiological and toxicological exposures to man from such releases. The models provide the Army with a decision-support tool for addressing health and safety considerations associated with depleted uranium released to the air under a range of scheduled or accidental conditions. In Section II the systematic sensitivity analysis used in this study is described. The model parameters and sensitivity/uncertainty evaluation for the air dispersion models and hazard exposure models are discussed in Section III. Section IV contains the conclusions drawn from the evaluation of model parameters from both the air dispersion and hazard exposure models.

40316 **(NUREG/CR—1793-V-1) Study of chemical toxicity of low-level wastes. Volume 1. Main report.** (General Research Corp., Santa Barbara, CA (USA)). Nov 1980. 262p. NTIS, PC A12/MF A01.

The chemical composition of fuel-cycle wastes is reasonably well known. By comparison, there is little information on the chemical composition of non-fuel cycle wastes. Such non-fuel cycle wastes come from a variety of sources - industrial, chemical, and medical. Because of the paucity of information, it is difficult to define the chemical characteristics and to evaluate potential hazards of non-fuel cycle wastes as a result of chemical toxicity. This report provides an assessment of the chemical toxicity of low-level radioactive wastes based on literature reviews, preparation of bibliographies and monographs, and application of a variety of methodologies either being currently applied or being proposed for relative hazard assessments. The report relies primarily on data from the Maxey Flats, Kentucky waste disposal site. While there are differences between humid and dry sites, the findings are believed to be generally applicable to evaluating the chemical toxicity of wastes at all low-level radioactive waste burial sites.

40317 **(NUREG/CR—1793-V-2) Study of chemical toxicity of low-level wastes. Volume 2. Monographs.** (General Research Corp., Santa Barbara, CA (USA)). Nov 1980. 225p. NTIS, PC A10/MF A01.

The chemical composition of fuel-cycle wastes is reasonably well known. By comparison, there is little information on the chemical composition of non-fuel cycle wastes. Such non-fuel cycle wastes come from a variety of sources - industrial, chemical, and medical. Because of the paucity of information, it is difficult to define the chemical characteristics and to evaluate potential hazards of non-fuel cycle wastes as a result of chemical toxicity. This report provides an assessment of the chemical toxicity of low-level radioactive wastes based on literature reviews, preparation of bibliographies and monographs, and application of a variety of methodologies either being currently applied or being proposed for relative hazard assessments. The report relies primarily on data from the Maxey Flats, Kentucky waste disposal site. While there are differences between humid and dry sites, the findings are believed to be generally applicable to evaluating the chemical toxicity of wastes at all low-level radioactive waste burial sites.

40318 **(INIS-mf—6815) Commentary on the book 'Nuclear Energy versus Coal. An Analysis' by ir. J.W. Storm van Leeuwen.** (Ministerie van Economische Zaken, The Hague (Netherlands)). [nd]. 96p. (In Dutch). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82780399.

This report gives a documented reaction to Storm van Leeuwen's book and also includes a response from the Minister to parliamentary questions over the Energy Policy Bill, with regard to the consequences of industrial energy generation for the energy analysis. The book has been studied by a panel of experts, all with practical experience in their own specific fields, and it is ascertained that a large number of findings need to be criticised. This report deals only with the following: the significance of the device energy analysis, energy analysis for the generation of electrical energy, safety and ecological aspects of nuclear energy. It is emphasised that other findings in the book have yet to be approved. The panel's conclusions are summarised in the bulk of the report and are accounted for in a number of appendices.

0550 Regulations

REFER ALSO TO CITATION(S) 40273, 40283, 40290, 40775

40319 **(LA—8955) Integrated international safeguards concepts for fuel reprocessing.** Hakkila, E.A.; Gutmacher, R.G.; Markin, J.T.; Shipley, J.P.; Whitty, W.J.; Camp, A.L.; Cameron, C.P.; Bleck, M.E.; Ellwein, L.B. (Los Alamos National Lab., NM (USA); Sandia National Labs., Albuquerque, NM (USA)). Dec 1981. Contract W-7405-ENG-36;AC04-76DP00789. 185p. (SAND—81-1311). NTIS, PC A09/MF A01. Order Number DE82008974.

This report is the fourth in a series of efforts by the Los Alamos National Laboratory and Sandia National Laboratories, Albuquerque, to identify problems and propose solutions for international safeguarding of light-water reactor spent-fuel reprocessing plants. Problem areas for international safeguards were identified in a previous Problem Statement (LA-7551-MS/SAND79-0108). Accounting concepts that could be verified internationally were presented in a subsequent study (LA-8042). Concepts for containment/surveillance were presented, conceptual designs were developed, and the effectiveness of these designs was evaluated in a companion study (SAND80-0160). The report discusses the coordination of nuclear materials accounting and containment/surveillance concepts in an effort to define an effective integrated safeguards system. The Allied-General Nuclear Services fuels reprocessing plant at Barnwell, South Carolina, was used as the reference facility.

40320 **(NUREG—0767) Criteria for selection of fuel cycle and major materials licenses needing radiological contingency plans. Regulatory report.** Fisher, F.D. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Jul 1981. 15p. NTIS, PC A02/MF A01.

Quantities of NRC-licensed radioisotopes requiring the licensee to develop and submit radiological contingency planning information to the NRC for review and approval are developed and presented as limiting possession limits and conditions of possession.

40321 **(NUREG—0768) People-related problems affecting security in the licensed nuclear industry. Technical report.** Spies, G.; Brittell, F.; Gross, D.; Hockert, J.; MacMurdy, P. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards). Mar 1981. 123p. NTIS, PC A06/MF A01.

The report discusses people-related problems in security forces at nuclear power reactors and nuclear fuel fabrication facilities regulated by the U.S. Nuclear Regulatory Commission. Security personnel issues are discussed under headings of corporate attitude toward security, security force management and organization, security officer selection and training, security force morale and security equipment. Problems are also discussed from the point of view of the government regulator, and possible changes in NRC policies, procedures and regulatory requirements (including ideas about possible federal licensing or certification of nuclear security personnel) are outlined. The report also includes appendices concerning the statistical basis for the report's conclusions, a behavioral reliability program for the nuclear industry and synopses of some existing licensing and certification programs.

40322 **(NUREG—0902) Site suitability, selection and characterization. Branch technical position: Low-Level Waste Licensing Branch.** Siefken, D.; Pangburn, G.; Pennifill, R.; Starmer, R.J. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Waste Management). Apr 1982. 28p. GPO $2.50.

The staff provides an expanded interpretation of the site suitability requirements in the proposed rule 10 CFR Part 61, a description of the anticipated site selection process, and a detailed discussion of the site characterization program needed to support a license application and environmental report. The paper provides early-on guidance to prospective applicants in these three subject areas.

40323 **(NUREG/BR—0025) Information report on state legislation.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of State Programs). 1 Jun 1982. 9p. U.S.N.R.C., Office of State Programs, Washington, DC.

Summaries of laws enacted by states, during 1982, dealing with the management of low-level radioactive wastes are presented in this report. Also included are adopted resolutions, introduced legislation and introduced resolutions. (DMC)

40324 **(PB—81-239519) New method of assigning uncertainty in volume calibration.** Lechner, J.A.; Reeve, C.P.; Spiegelman, C.H. (National Bureau of Standards, Washington, DC (USA)). Dec 1980. 108p. (NBSIR—80-2151). NTIS, PC A06/MF A01.

This paper presents a practical statistical overview of the pressure-volume calibration curve for large nuclear materials processing tanks. It explains the appropriateness of applying splines (piecewise polynomials) to this curve, and it presents an overview of the associated statistical uncertainties. In order to implement these procedures, a practical and portable FORTRAN IV program is provided along with its users' manual. Finally, the recommended procedure is demonstrated on actual tank data collected by NBS.

40325 **(PB—81-808115) Nuclear materials safeguards. 1979-July 1981 (citations from the NTIS data base). Report for 1979-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 383p. NTIS PC N01/MF N01.

Citations cover the methods of safeguarding nuclear materials through effective management, accountability, nondestructive assays, instrumentation, and automated continuous inventory systems. Problem areas and recommendations for improving the management of nuclear materials are included. (This updated bibliography contains 376 citations, 260 of which are new entries to the previous edition.)

40326 **(PNL-SA—8443) Use of process monitoring data to enhance material accounting.** Brouns, R.J.; Smith, B.W. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. Contract AC06-76RL01830. 14p. (CONF-800655—37). NTIS, PC A02/MF A01. Order Number DE82008562.

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

A study was conducted for the United States Nuclear Regulatory Commission as part of a continuing program to estimate the effectiveness of using process monitoring data to enhance special nuclear material accounting in nuclear facilities. Two licensed fuel fabrication facilities with internal scrap recovery processes were examined. The loss detection sensitivity, timeliness and localization capabilities of the process monitoring technique were evaluated for single and multiple (trickle) losses. The impact of records manipulation, mass and isotopic substitution, and collusion between two insiders as methods for concealing diversion were also studied.

40327 **(SAND—82-0548C) Session 17: item identification and seals; technology and experience.** McKenzie, J.M. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 15p. (CONF-820327—1). NTIS, PC A02/MF A01. Order Number DE82008215.

From International training course on implementation of state systems of accounting for a control of nuclear materials; Santa Fe, NM, USA (15 Mar 1982).

Seals and surveillance and containment equipment provide techniques to monitor items. Each technique individually provides a confidence level which can be assigned to a statement about the identity and integrity of an item. Simultaneous use of both techniques results in an improved confidence level assignment to the identify/integrity statement. Thus the two techniques, although they can be used separately, actually complement each other when used together. The field of security seals is particularly active. Fiber optics, and ultrasonic seals, are in a state of flux. New developments and better devices are to be expected. The potential of instrument surveillance and containment has yet to be realized. Acceptance of innovative ideas is slow, at least in the initial stages.

40328 **Quantification of nuclear-diversion risks: promises and problems.** Heising, C.D. (Massachusetts Inst. of Technology, Cambridge). *Energy Policy;* **10**: No. 2, 101-108(Jun 1982).

The spread or proliferation of nuclear weapons has been identified as a crucial risk associated with the worldwide deployment of nuclear power. However, little analytic work has been done to establish the degree of this risk as most policy discussions have been based on qualitative assessments. This paper suggests that a quantitative, risk analysis approach towards proliferation-related policy deliberations can help guide the decision making process. Review and application of independently derived risk analysis procedures, that quantify the resistance of various nuclear fuel cycles to diversion, reveals that a lesser degree of correlation between nuclear power and proliferation exists than has previously been suggested by qualitative analyses. 4 figures, 3 tables.

06 FUSION FUELS

0602 Processing

40329 **(DOE/DP/40021—T1) Evaluation of ammonia-borane as a laser-fusion-target material. Final progress report, March 1, 1978-May 31, 1978.** Geanangel, R.A. (Houston Univ., TX (USA). Dept. of Chemistry). 1978. Contract AS05-76DP40021. 22p. (ORO—5176-8). NTIS, PC A02/MF A01. Order Number DE82011600.

Significant results from the previous three quarterly reports are reviewed. Ammonia-borane should be zone sublimed prior to use in fabrication experiments because it is found to undergo an unspecified decomposition which lowers the melting point but does not release significant amounts of hydrogen. Ammonia-borane microballoons, formed by the liquid droplet method, were mounted on glass stalks using epoxy cement and inspected by optical and electron microscopy. Microballoons which had been gold-coated showed expansion and severe surface cracking not visible in optical micrographs or in electron micrographs of uncoated shells. Heating from gold deposition is believed to be responsible for the degradation. Several good quality microballoons were observed. Uncoated, these showed no expansion or surface cracking in the vacuum of the SEM.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

40330 **(CONF-820233—1) Stable-isotope-enrichment program at the Oak Ridge National Laboratory.** Newman, E. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE82008377.

From National Research Council workshop on stable isotopes and derived radioisotopes; Washington, DC, USA (3 Feb 1982).

This paper has attempted to present a brief description of the production steps, from the selection and preparation of the initial feedstock to the recovery and distribution of the isotopically enriched materials. The facility suffers from the disadvantage of coping with utility and support systems that are rapidly becoming obsolescent and that the current operational level is insufficient to maintain sales inventory equilibrium. The electromagnetic isotope enrichment facility does, however, have the operational equipment and capability to almost triple the current production. This increased production can be achieved as rapidly as an expanded operational crew can be trained.

40331 **(PB—81-856577) Heavy water. January 1970-December 1980 (citations from the NTIS Data Base). Report for January 1970-December 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 225p. NTIS PC N01/MF N01.

The cited reports of Federally funded research cover studies, applications, testing, and production of heavy water. Discussions of applications in trace studies, deuterium oxide as a moderator in nuclear reactors, and safety regulations for handling heavy water are also included. (Contains 200 citations, fully indexed and including a table of contents.)

40332 **(PB—81-856585) Heavy water. January 1976-December 1980 (citations from the Energy Data Base). Report for January 1976-December 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 220p. NTIS PC N01/MF N01.

Global information covers studies, applications, testing, and production of heavy water. Discussions of applications in trace studies, deuterium oxide as a moderator in nuclear reactors, and safety regulations for handling heavy water are also included. (Contains 200 citations, fully indexed and including a table of contents.)

40333 **(PB—81-856593) Heavy water. January 1970-December 1980 (citations from the Engineering Index Data Base). Report for January 1970-December 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 171p. NTIS PC N01/MF N01.

Global information covers studies, applications, testing, and production of heavy water. Discussions of applications in trace studies, deuterium oxide as a moderator in nuclear reactors, and safety regulations for handling heavy water are also included. (Contains 172 citations, fully indexed and including a table of contents.)

0702 Radiation Sources

REFER ALSO TO CITATION(S) 40331, 40332, 40333, 41301

40334 **(AD-A—097936/9) Composite screens used as a radiographic aid. Final report.** DerBoghosian, S.; Coates, A.J. (Army Materials and Mechanics Research Center, Watertown, MA (USA)). Mar 1981. 18p. (AMMRC-TR—81-11). NTIS PC A02/MF A01.

Tests evaluating fluorometallic or composite X-ray intensifying screens have shown that these screens can be valuable and useful accessories in the field of industrial radiography. In many applications, they can increase inspection efficiency by reducing exposure times and possibly lowering the kilovoltages which are required when using conventional lead screens. The radiographic tests were performed using steel plates ranging in thickness from 0.250 to 4.0 inches in the 150 kV to 2.5 MeV radiation quality range with ASTM film classes 1 and 2. Image resolution assessment was based upon penetrameter requirements (2-2T) set forth in MIL-STD-453, Inspection, Radiographic. The resultant radiographs using these screens attained at least the 2-2T quality required by most codes. The high speed screen appears to offer more advantages than the high definition screen.

40335 **(CONF-810647—Absts.) Abstracts of papers to be presented at the fifth symposium on x- and gamma-ray sources and applications.** (Michigan Univ., Ann Arbor (USA)). 1981. Contract FG02-80EV10344. 43p. NTIS, PC A03/MF A01. Order Number DE82011862.

From Conference on X- and gamma-ray sources and applications; Ann Arbor, MI, USA (10 Jun 1981).

The program and abstracts of papers are presented. Topics include radiation sources, radiation detectors, mathematical models and data analysis, gamma-ray spectroscopy, instrumentation, applications of x-ray fluorescence, PIXE, and x-ray absorption. (ACR)

40336 **(KFK—3155) Neutrino physics at the Spallation Neutron Source.** Zeitnitz, B. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kern- und Teilchenphysik). Mar 1981. 38p. Institut fuer Kern- und Teilchenphysik, Kernforschungszentrum Karlsruhe, GmbH, Karlsruhe, Germany.

The advantages which the new high intensity neutron spallation sources will offer for neutrino physics are discussed. The experimental area planned for neutrino measurements at the SNQ (Spallations-Neutronen-Quelle) is presented. An experiment to search for neutrino oscillations ν/sub μ/ $\rightleftharpoons$ ν/sub e/ is proposed.

0703 Isotopic Power Supplies

REFER ALSO TO CITATION(S) 40919

40337 **(PB—81-855991) Radioisotope batteries and thermoelectric power generation. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 76p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the research, design, development, testing, economics, and a wide variety of applications of radioisotope batteries used as heat sources and thermoelectric power generators. Measurement of biological and environmental radiation effects of radioisotope batteries and safety factors relating to them are included also. (Contains 67 citations, fully indexed and including a table of contents.)

40338 **(PB—81-856007) Radioisotope batteries and thermoelectric power generation. January 1972-November 1980 (citations from the International Aerospace Abstracts Data Base). Report for January 1972-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 117p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the research, design, development, testing, economics, and a wide variety of applications of radioisotope batteries used as heat sources and thermoelectric power generators. Measurement of biological and environmental radiation effects of radioisotope batteries and safety factors relating to them are included also. (Contains 111 citations, fully indexed and including a table of contents.)

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 40364, 40419, 41205, 41205, 41207, 41469, 41532

40339 **(EUR—6603-FR) Study of a cell for electrolytic generation of hydrogen with depolarization by SO_2.** Feuillade, G.; Caradec, J.Y. (Compagnie Generale d'Electricite (CGE), 91 - Marcoussis (France)). 1981. 39p. (In French). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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Electrochemical oxidation of SO_2 in sulphuric acid solutions was studied in various concentration (44% to 91%) pressure (0 to 20 atm) and temperature (20 to 80°C) conditions, in order to have a complete knowledge of the electrochemical step of the so called SO_2 thermoelectrochemical cycle for hydrogen production. Even with noble metal catalyzed electrodes, results are very poor (say 6 kAm^{-2} at 1 Volt versus Hydrogen electrode). They were even poorer when the reaction was studied in complete cells with electrolyte flow, due to ohmic drops and cathodic overvoltages. It seems to us that these difficulties are a constringent limitation to further development of the process.

40340 **(EUR—6965-DE) Hybrid processes for the production of hydrogen. Final report.** Seeger, W.; Steeb, H. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Stuttgart (Germany, F.R.)). 1980. 238p. (In German). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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Research and development work was undertaken to find novel hybrid electrochemical cycles for the production of hydrogen from water and to examine relevant electrolytic reactions in aqueous solution for generating hydrogen; reactions were to be restricted to inorganic compounds and metal deposition was to be avoided. Investigations dealt with the selection of electrolytes and complementary thermochemical reactions and with the identification of reactions critical to the thermochemical cycles and their substitution by electrolytic reactions. Three hybrid processes were investigated involving copper, iron, and antimony. It was concluded that electrolytes genrating only hydrogen were of interest for hybrid cycles. Reduction to gaseous hydrogen should be combined with the oxidation of metallic cations in an acid medium. Electrolytic oxygen generation must be prevented. 30 references, 139 figures, 5 tables.

40341 **(EUR—7540-EN) Use of immobilized hydrogenase for hydrogen production.** Durand, G.; Hatchikian, C.; Le Gall, J.; Monsan, P. (Institut National des Sciences Appliquees (INSA), 31 - Toulouse (France)). 1981. 44p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The present study shows that the hydrogenase from Desulfovibrio gigas can efficiently be coupled onto aliphatic-amino and aromatic amino Spherosil. The highest enzymatic activity (4440 U/g support) and immobilization yield is obtained when reacting hydrogenase, in the presence of cytochrome C_3 or CC_3, with diazotized aromatic-amino silica. This derivative catalyzes the production of about 0.1 liter hydrogen gas per min. and per g support at 37°C, under 1 atmosphere, using dithionite as the electron source. Activities clearly higher than those previously reported in the literature could thus be obtained. Furthermore, this highly active immobilized hydrogenase shows a good resistance to oxygen inactivation. Preliminary results indicate that hydrogen could be evolved by coupling these derivatives with illuminated chloroplasts, and that immobilized hydrogenase could be used repeatedly with a good efficiency. It is now necessary to optimize the coupling of immobilized hydrogenase with chloroplasts and to identify the limiting steps of the reaction, to assess the possibility of hydrogen photoproduction at a pilot scale.

40342 **(EUR—7572-EN) Study of anodic and cathodic catalysts for water electrolysis activation of membranes and diaphragms. Final report.** (Panclor S.p.A., Milan (Italy)). 1981. 84p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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This project had to deal with different types of electrocatalysts and separators for water electrolysis, with particular regard to their use in alkaline media. The attained milestones were: New samples of cathodic and anodic catalysts were prepared and submitted to polarizatios, up to 1350C and 2000 h. Sulfur-activated Ni has shown good performance as cathod. Ru and Re are excellent but costly materials. Ni- and Co-stainless steel alloys are very good anodic activators. New catalysts have been prepared by deposition from inorganic and from organic salts. In the first class the only promising anodic ones were based on Ni and Co. Cathodic catalysts, even including Re and Ru besidesffered considerable weight loss. In the organic class many results have been reported, where a

formulation called D-47 (2Ni/1Co/1Zn+10%Mo) was particulary relevant on the cathodic side. Four small-scale pressure bipolar electroyzers designed to operate at 30 bar max and 140ere constructed and installed in an appropriate pilot plant, to carry out endurance tests for the best catalysts and separators. The plant operation is fully automatically controlled. After a careful system's calibration, the most promising cathodes and anodes have been tested, either individually, against pure nickel counterelectrodes, or coupled. The best coupling of catalysts prepared from organic acid salts gave a cell voltage efficiency up to 85%, using Nafion membrane in LiOH) as separtors. Membranes and diaphragms have been evaluated in tests under pressure, making use of the above pilot plant. Styrenic membranes have been evaluated for 250 h periods in comparison with available Nafions. Sulfonated polyphenylenesulfide diaphragms have also been tested, even if not extensively.

40343 (EUR—7573-EN) Novel oxides having high protonic conductivity as electrolyte for low-temperature water-vapour electrolysis. Final report. (Panclor S.p.A., Milan (Italy)). 1981. 35p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Main goal of the contract was the application of protonic conduction materials for the electrolysis of the water-vapor system at 200 to 300°C. The following materials were examined: γ - AlOOH, α-FeOOH, SbOOH H(H_2O/sub x/) β'' alumina. All the materials have been characterized by means of chemical analysis, x-ray, thermogravimetry, I.R. spectroscopy, and surface measurements. The protonic conduction characteristic of the materials have been tested by means of E.M.F. and conductivity measurements. It appears that only the hydronium β'' alumina can be used as proton conductor material. In fact an acceptable proton conductor has to have specific conductivity in the order of 10^{-1} ohm^{-1} cm^{-1}. As consequence of these results the research has been oriented to the technological evaluation of the hydronium β'' alumina. Preliminary electrolysis tests with the hydronium β'' alumina have shown a relevant embrittlement of the material after 30 to 60 min of electrolysis at 250°C. These preliminary tests have been carried out with specimens of 1-2.5 mm of thickness. Black platinum has been pressed on the surfaces. With thickness in the range 0.1 to 0.5 mm and current density of 1 A/cm^2 the potential drop should be of the order of 0.1 to 0.5 V, and the cell potential for the electrolysis should be of 1.2 to 1.6 V according to the specimens thickness. As consequence of the above results and considerations we tried to fabricate specimens of thickness in the range of 0.1 to 0.5 mm. Up to now all the materials prepared with different methodology show good values of conductivity; however, they, still have low mechanical properties since they are very brittle and cannot be used in electrolysis cells.

40344 (EUR—7574-EN) Study of the optimal structure of a solid-polymer electrolyte for water electrolysis. Final report. (Panclor S.p.A., Milan (Italy)). 1981. 70p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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The aim of the contract was to understand the electrochemical behavior of the membrane in electrolysis process, to correlate the membrane electrochemistry with the membrane structure, and to develop methodologies suitable to improve the present water electrolysis technology. The results that have been obtained from this research are summarized. The electrolyte uptake into the membrane depends on the fixed charge density and on the external aqueous electrolyte concentration. At a given aqueous electrolyte concentration, the membrane salt invasion is inversely proportional to the increase of the fixed charge density, and directly proportional (for a given density of fixed charge) to the external electrolyte concentration. The membrane resistance depends on the mobility and concentration of membrane ions, and decreases in accordance with the fixed charges density, and (for a given fixed charge density), with the external electrolyte concentration. Further the membrane resistance depends on the cation according to the series K > Na > Li. The salt invasion of the membrane implies a reduction of the cation transport number with respect to the unity, and an increase of the membrane conductivity. The first effect (T/sub cation/ < 1) is of importance in chloro-alkali type electrochemical process, where the efficiency of the alkali production depends on the cation transport number across the membrane, but is not relevant for the production of hydrogen by water electrolysis. On the other hand the increase of conductivity is relevant to the electrolytic production of hydrogen. The observation that in the presence of Li^+ the surface membrane resistance is of the order of 0.7 to 1.2 Ωcm^2 has led to a water electrolysis process where non noble metals as electrocatalysts deposited on the membrane surface can be used. Extensive research on membrane electrocatalyst deposition methodology, suggests that the best results are obtained electroless technology.

40345 (EUR—7589-EN) Biophotolysis of water for H_2 production via natural and artificial catalytic systems. (King's Coll., London (UK)). 1982. 70p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The characteristics of a biocatalytic system (containing chloroplast membranes, ferredoxin and hydrogenase) which can produce H_2 from water using solar energy were studied. An in vitro system of chloroplasts (Chenopodium), ferredoxin, (Spirulina), and hydrogenase (Clostridium) (with oxygen scavengers) liberated H_2 gas continuously for four to six hours, at the rate of 50 μmoles H_2 per h per mg chlorophyll when illuminated with light at 11000 lux at 25°C. The rate and longevity of the reaction dependend upon the light- and oxygen-stability of the chloroplasts and hydrogeneases and the recycling efficiency of the electron mediator. A number of techniques were tried to immobilize chloroplast membranes and thus improve their stability in light. Hydrogenases with varying sensitivity towards oxygen were isolated from different types of bacteria and algae and the suitability of natural and artificial mediators to couple these hydrogenases to the electrons photochemically generated from chloroplasts were investigated. Artifically synthesized particles containing Fe, Mo, S and other minerals (Jeevanu) and a thiolated cluster of Fe-Mo and S were able to mediate electron transfer from chloroplasts to Clostridium hydrogenase. Preliminary experiments were done on the stability and efficiency in H_2 production of a chloroplast-hydrogenase system embedded in calcium alginate gel spheres. An electrode device which can continuously and simultaneously measure the H_2 and O_2 generated in the system has been set up for continuous monitoring procedures.

40348 (EUR—7607-EN) Photocatalytic production of hydrogen from water, using sunlight. Final report. Mackor, A.; Alberts, A.H.; Tinnemans, A.H.A. (Organisch Chemisch Inst. TNO, Utrecht (Netherlands)). 1981. 75p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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Attention was concentrated on the generation of hydrogen from aqueous solutions, containing a light-absorbing compound (e.g. $Ru(bipy)_3^{2+}$), an energy-transferring agent (e.g. methylviologen MV^{2+}), a catalyst (e.g. Pt) and an electron-donating substrate (e.g. triethanolamine TEA). Various cycles have been developed, based on this principle, in which the substrate is consumed (sacrificial systems). It was realized that an oxygen-evolution cycle had to be developed. Sacrificial systems were proposed in which water was oxidized, e.g. by the oxidized form of $Ru(II)(bipy)_3^{2+}$, which would result from the hydrogen-producing reaction $4\ Ru(III)(bipy)_3^{2+} + H_2O \rightarrow 4\ Ru(II)(bipy)_3^{2+} + O_2 + 4H^+$. Co(III) complexes and the $S_2O_8^{2-}$ ion were used as electron-acceptors. The coupling of hydrogen- and oxygen-cycles was accomplished by Graetzel, using highly active Pt and RuO_2 catalysts. The method of preparation for these catalysts is very crucial and there is some uncertainty as to the reproducibility of this observation among various groups. We are presently attempting to reproduce Graetzel's system. Since the formation of O_2 involves the tranfer of 4 electrons, it is this step, which may determine the success of a water-cleaving process. Some novel binuclear Ru-Ru complexes have been synthesized, which can act as two-electron acceptors. Their

behavior in the O_2-forming part of the water-cleaving system is presently under study.

40347 **(EUR—7610-EN) Gas bubble behaviour and ohmic potential drop during water electrolysis. Final report.** Sillen, C.W.M.P.; Janssen, L.J.J.; Geraets, J.; Goedkoop-Kooijan, A.G. (Technische Hogeschool Eindhoven (Netherlands)). 1981. 92p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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The aim of the hydrogen program of EC is to minimize energy losses during water electrolysis. This investigation contributes to the fundamentals for an advanced water electrolysis. The subjects of the present study are the following: the behaviour of bubbles at perforated electrodes pressed against diaphragms of different materials, the ohmic resistance of a layer of solution between diaphragm and working electrode and the bubble size and distribution in the solution leaving the electrolytic cell. Using electrodes with gaps in it pressed against a diaphragm, it is very important that the gaps remain free of gas bubbles. Whether or not the gaps are filled up by bubbles depends on material of diaphragm and on the geometry of electrode. It has been found that the best electrode, in this respect, of the ones which have been investigated is the expanded metal gauze electrode. However, in pressing this electrode type against the diaphragm, the latter is often damaged, since this electrode has gaps mostly with very sharp edges. For perforated plate electrodes it is observed that the round gaps are easily filled up with large bubbles, (very unfavorable), if a diaphragm of nafion, $K_2Ti_6O_{13}$/PTFE, Polysulfone or ZrO/sub x//PTFE is used. Asbestos or PAM/PS-diaphragms act differently: no large bubbles fill up the gaps. The occurrence of large bubbles in the gaps is probably caused by the poor wettability of PTFE and Polysulfone.

40348 **(EUR—7661-EN) Non-fossil-derived hydrogen in coal-conversion processes: a further study. Final report.** Merrick, D.; Smith, M.; Rasmussen, G. (Coal Research Establishment, Cheltenham (UK)). 1982. 138p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Porcess for the conversion of coal to liquid and gaseous fuels generally require hydrogen. This is generated internally from coal, a by-product hydrocarbon or carbon residue. The use of hydrogen from a non-fossil energy source, for example nuclear power, has the advantages that it could extend coal reserves and also provide a convenient means of storing hydrogen. This report summarizes a study on the use of non-fossil derived hydrogen in coal conversion processes. A technical and economic appraisal has been carried out on two processes representative of near-term technology. The results are compared with those obtained from an earlier study. In each case, the introduction of non-fossil derived hydrogen results in an increased thermal efficiency and product yield. Comparison of the economics of non-fossil hydrogen use with the processes in the first study, indicates that a hydrogasification process would be perferred for the producion of substitute natural gas and a hydrogenation process for the production of liquid fuels. In addition, an analysis has been made of the economics of producing hydrogen from a dedicated nuclear power plant/electrolyzer system and an off-peak nuclear electricity/electrolyzer system. The economic implications of using such hydrogen in the substitute natural gas (hydrogasification) and liquefaction (hydrogenation) processes were evaluated. The analysis indicates that a low capital cost advanced electrolyzer plant is necessary for the non-fossil derived hydrogen route to synthetic fuels to be competitive with the conventional coal conversion technology, under existing nuclear fuel costs and coal prices. It is also shown that, for advanced electrolyzer plant, the off-peak electricity system is preferred to the dedicated nuclear power plant system.

40349 **(EUR—7682-EN) Photochemical dissociation of water by means of visible light. Final report. Final report.** Harriman, A.; Porter, G. (Royal Institution, London (UK). Davy Faraday Research Lab.). 1982. 142p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The purpose of this investigation is to construct and in vitro model of photolysis based on photosystem II (PSII). Photosynthesis provides the only practical solution for the collection and storage of solar energy. This is achieved by coupling together two photoreactions; one reaction reduces CO_2 to the level of carbohydrate whilst the second reaction leads to the oxidation of water to molecular oxygen. This second step is of great current interest since, by itself, it is capable of storing solar energy in the form of a chemical fuel. It can be represented as $2Q + 2H_2O \rightarrow 2QH_2 + O_2$ where Q is a quinone. Although the detailed mechanism of this reaction is far from clear, it is believed that a manganese complex acts as the active catalyst for oxidation of water whilst chlorophyll acts as the photosensitizer. (DMC)

40350 **(PB—81-246522) Assessment of nonfossil hydrogen. Final report.** Fein, E.; Munson, T. (Futures Group, Glastonbury, CT (USA)). Dec 1980. 221p. NTIS, PC A10/MF A01.

The study examined the potential for hydrogen produced from nonfossil energy sources as an energy carrier. Analyses were made of proposed hydrogen production technologies: water electrolysis, thermochemical systems, and various solar radiation processes. Long-term and short-term hydrogen storage technologies were also evaluated. Various possible hydrogen end-uses were appraised, including its role as an industrial chemical, a heating fuel for stationary applications, a vehicular fuel, and an aircraft fuel. The role of coal in future hydrogen production was seen as providing the major competitive technology to nonfossil hydrogen production. The study analyzed conditions (constraints placed on the use of natural fossil fuels and synthetic fossil fuels) under which hydrogen may be produced primarily from nonfossil energy sources. A possible scenario was suggested for the transition to a nonfossil energy era, and areas where hydrogen could be expected to contribute to domestic energy needs were indicated.

40351 **(PB—81-808750) Hydrogen production. 1978-May 1980 (citations from the NTIS data base). Report for 1978-May 1980.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 207p. NTIS PC N01/MF N01.

The cited reports include studies on the manufacturing of hydrogen by electrolysis, coal gasification, and other techniques. They cover both experimental research and production on the industrial scale. Although most of the reports are on production methods, economic studies are also included. (This updated bibliography contains 200 citations, none of which are new entries to the previous edition.)

40352 **(PB—81-808768) Hydrogen production. June 1980-August 1981 (citations from the NTIS data base). Report for June 1980-August 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 124p. NTIS PC N01/MF N01.

The cited reports include studies on the manufacturing of hydrogen by electrolysis, coal gasification, and other techniques. They cover both experimental research and production on the industrial scale. Although most of the reports are on production methods, economic studies are also included. (This updated bibliography contains 117 citations, all of which are new entries to the previous edition.)

40353 **(TAC-H—81-004) Hydrogen energy: a bibliography with abstracts. Quarterly update, October-December 1981.** (New Mexico Univ., Albuquerque (USA). Technology Application Center). Dec 1981. 102p. Univ. of New Mexico, Technology Application Center, Albuquerque, NM 87131.

This issue of Hydrogen Energy cites 169 additional references identified during the third quarter of 1981. Production, utilization, safety, materials, transmission, distribution, and storage are covered.

40354 **1980 annual status report: hydrogen production, energy storage and transport.** Luxembourg; Commission of the European Communities (1981). 6p. (EUR—7254-EN). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

The third project is study of systems: evaluation of various possible systems for collection-conversion-transmission-storage-utilization of energy under different conditions. This project, also on the basis of existing competences and still in a preliminary period, could give a contribution to selections and decisions concerning different systems for solving the problem of converting and transporting energy, in large quantities and over long distances. The elements prepared for the selections are based both on economic and energy analysis, useful not only for decisions convenient in the short time but also in a more general, long term view.

40355 **Improved efficiency in the sulfur dioxide - Iodine hydrogen cycle through the use of magnesium oxide.** Mason, C.F.V.; Bowman, M.G. (California University, Los Alamos, NM). pp 1411-1414 of Proceedings of 16th intersociety energy conversion engineering conference, Atlanta, GA, August 9-14, 1981. Volume 2. New York, NY; American Society of Mechanical Engineers (1981).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

The reaction of iodine with dry magnesium oxide and magnesium sulfite hexahydrate was studied experimentally as a possible means of improving the efficiency of the sulfur dioxide-iodine cycle. When no extra water was introduced, the maximum product yield was 67% obtained at 423 K. With excess water vapor, a nonporous plug was formed which prevented complete reaction. In the second case, maximum yield was 62% measured at 423 K showing that added water does not increase reaction products. This reaction gives an alternate route for producing hydrogen from water via the sulfur dioxide-iodine process.

40356 **(PB—82-105362) Electrolytic production of hydrogen by the electrochemical reduction of water at 850 degrees C. design and determination of the properties of a flat plat electrolytic cell of 50 cm2 (production electrolytique d'hydrogene par reduction electrochimique de l'eau a 850 degrees c. construction et determination des caracteristiques d'une cellule d'electrolyse plane de 50 cm2). Final report.** Viguie, J.C. (Commission of the European Communities, Luxembourg). [nd]. 39p. NTIS PC E03/MF E03.

The electrochemical chain is: H_2, H_2O/Ni/0.91 ZrO_2;0.09 Y_2O_3/oxide/O_2. The influence of preparation on the resistivity of the solid electrolyte has been studied. A typical figure is 18 omega cm at 850C. The cathode reactivity is dependent on the superficial concentration of the nickel grains on the interface. Studies of the current-overvoltage relations indicate that the maximum reactivity is achieved with a superficial resistance R ranging between 50 and 150 microomega. The disc support is a honeycomb shaped ceramic whose composition was adjusted to meet the expansion coefficient of zirconia .000009/C. The support is chemically covered with a 15 microns nickel layer. Trial runs were made (a) to insure that anodic and cathodic compartments were isolated and (b) to determine the proper gas flow conditions.

0802 Storage

REFER ALSO TO CITATION(S) 40353, 40361, 40362

40357 **(NASA-TM—75723) Use of reversible hydrides for hydrogen storage.** Darriet, B.; Pezat, M.; Hagenmuller, P. (National Aeronautics and Space Administration, Washington, DC (USA)). Dec 1980. 18p. NTIS PC A02/MF A01.

The addition of metals or alloys whose hydrides have a high dissociation pressure allows a considerable increase in the hydrogenation rate of magnesium. The influence of temperature and hydrogen pressure on the reaction rate were studied. Results concerning the hydriding of magnesium rich alloys such as Mg_2Ca, $La2Mg_{17}$ and $CeMg_{12}$ are presented. The hydriding mechanism of $La2Mg_{17}$ and $CeMg_{12}$ alloys is given.

40358 **(PB—82-105404) Enquiry into the storage of hydrogen by means of cryoadsorbents (untersuchung der wasserstoffspeicherung mit kryoadsorbern). Final report 1 Oct 76-31 Sep 77.** Carpetis, C.; Peschka, W. (Commission of the European Communities, Luxembourg). 1981. 128p. NTIS PC E06/MF E06.

As a preliminary to the study of adsorbents suitable for the storage of hydrogen by cryoadsorption, three other storage methods were investigated and compared with storage by cryoadsorbents: (1) liquefied gas storage; (2) storage by means of metal hydrides; (3) compressed gas storage. Guidelines are given for estimating the capital cost of installations, annual fixed charges, and energy costs. A computer program evaluates the economics of the four methods and arrives at a storage effectiveness factor for each, taking account of size of installation, storage capacity, operating temperature and pressure, number of operating cycles per year (time required for input into the storage capacity and for withdrawal of hydrogen).

40359 **(PB—82-800095) Hydrogen storage: hydrogen as a hydride. 1974-August, 1981 (citations from the NTIS Data Base). Report for 1974-Aug 81.** (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 173p. NTIS PC N01/MF N01.

The bibliography covers hydrogen storage as a hydride. Topics include the chemical and physical properties of the hydride, and how useful it may be for hydrogen storage. Also considered is the conversion of hydrogen to a hydride and the conversion back to hydrogen. (This updated bibliography contains 164 citations, 29 of which are new entries to the previous edition.)

40360 **(PB—82-800103) Hydrogen storage: storage as a gas or liquid. 1974-August, 1981 (citations from the NTIS Data Base). Report for 1974-Aug 81.** (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 182p. NTIS PC N01/MF N01.

The bibliography relates to storing hydrogen as a liquid or a gas. Topics include fuel storage, energy storage, and the construction of tanks used to store the material. Any type of storage that is related to batteries, fuel cells, or solar cells are excluded, unless the abstract states that its purpose is to store hydrogen. (This updated bibliography contains 173 citations, 29 of which are new entries to the previous edition.)

0803 Transport

REFER ALSO TO CITATION(S) 40353, 40362

40361 **(EUR—7423-DE) Development of high-pressure tanks with laminated fiber reinforcement for storage of GH_2.** Tronsberg, W. (Maschinenfabrik Augsburg-Nuernberg (M.A.N.) A.G., Nuernberg (Germany, F.R.)). 1981. 158p. (In German). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

A method of manufacturing fully reinforced, high-pressure tanks for the movement of hydrogen gas by road and rail is described. The aim of the project was to build and test a tank, which had to fulfill the following conditions: an increase in payload when transporting gas achieved by reducing the weight of the tank; an increase in the operating pressure of the tank; a reduction, or complete elimination of the embrittlement of the tank material due to the effects of the hydrogen inside; and an increase in the safety of the tank during handling and transport (e.g. no splintering when a leak occurs). A concept for a tank of composite construction was taken as a basis for the model investigation: co-supporting, corrosion-resistant liner to make the tank leak-proof. This has two openings at the ends made of hydrogen-reistant steel; multi-layer, carbon fibre reinforcement in a resin matrix, attached by the laminated sheet process and acting as a supporting component; and epoxy resin protective coating, sprayed on. The following manufacturing methods were used: construction of liner from two flow-turned halves joined by electron beam welding; construction of liner from

two turned end pieces, one rolled, straight-bead-welded and expanded central pipe; these parts joined by electron beam welding; and reinforcement plating: crossed layers at the ends, all-round layers in the cylindrical part. Four tanks were manufactured and tested. After being pressurized to 150 bar 10 times, each for one minute, two tanks were burst: SN 1 = 220.8 bar and SN 2 = 222.9 bar. Tanks SN 3 and SN 4 were subjected to periodic test cycles: SN 3 achieved 1181 cycles; and Tank SN 4 achieved 1849 cycles. On all four tanks tested, expansion and changes in the length of the tanks were measured at intervals of 10 bar and recorded on a printout. Examinations of the hardness and the joints were carried out on the burst tanks.

0804 Marketing And Economics

REFER ALSO TO CITATION(S) 40351

0805 Safety

40362 **(EUR—6854-DE) Safety aspects of a future European hydrogen technology. Final report.** (Dornier-System G.m.b.H., Friedrichshafen (Germany, F.R.)). 1980. 266p. (In German). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Portions of document are illegible.

The report covers the physiological, physical and chemical properties of gaseous and liquid hydrogen, a comparison with other fuel gases, and an analysis and comparative evaluation of the associated hazards. Details are given of technical experiences with hydrogen, its storage and gas detection systems. Safety regulations and their use, especially with regard to containerization and the various forms of its transportation are outlined. A European Safety Guide for hydrogen will involve detailed work to standardize the laws and regulations in force in the various EEC countries, some of which are given in the Appendix. 109 references.

0806 Industrial And Commercial Use

REFER ALSO TO CITATION(S) 40353

0808 Properties

REFER ALSO TO CITATION(S) 40362

09 OTHER SYNTHETIC AND NATURAL FUELS

REFER ALSO TO CITATION(S) 40726

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 40105, 40111, 40116, 40214, 40215, 40394, 40396, 40423, 40426, 40427, 40428, 40429, 40430, 40431, 40434, 40444, 40449, 40914, 41234, 41237, 41238

40363 (ANL/CNSV-TM—95, pp 175-193) **Cleaning and use of digester gas as a vehicle fuel.** Meloy, W.R. (Brown and Caldwell, Eugene, OR). Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

This paper discusses how sludge gas can be cleaned and used as a vehicle fuel in conventional automobiles. The cost of cleaning the gas with a water scrubber is approximately equal to the cost of natural gas in many areas. As the cost of natural gas goes up, the scrubbed sludge gas will be competitive. The cost of gas plus the cost of vehicle conversion gives about a 20 percent savings in the fuel costs at today's prises. As gasoline prices rise, this advantage may also increase. The final decision on use of sludge gas as a vehicle fuel depends on the situation faced by the owner. The cost of gasoline, the cost of power, the availability and use of vehicle fleet as well as many other factors must be evaluated and compared with alternative uses of the resource. This paper has endeavored to point out many of the items to be considered; however, the final answer for one plant may be quite different than for the next. For instance, the overall cost of $1.06 per equivalent gallon of gasoline estimated for the hypothetical plant mentioned in this paper may be extremely attractive to an agency looking for an independent source of vehicle fuel.

40364 **(DOE/ER/04946—4) Studies of metal. Semiconductor interfaces in catalysis and energy conversion. Annual report, June 15, 1981-June 14, 1982.** Chung, Y.W. (Northwestern Univ., Evanston, IL (USA)). Feb 1982. Contract AS02-78ER04946. 42p. NTIS, PC A03/MF A01. Order Number DE82011863.

We showed that CO is chemisorbed molecularly on both Ni(111) and $Ni/TiO_2(100)$ surfaces near room temperature, but is suppressed by a factor of 2 to 2-1/2 on the $Ni/TiO_2(100)$ surface. X-ray photoemission reveals that the carbon 1s level for CO adsorbed on $Ni/TiO_2(100)$ has a smaller binding energy (by about 0.6 eV) than Ni(111), indicating chemical state differences. High pressure (up to 80 Torr total pressure) CO hydrogenation studies on $Ni/TiO_2(100)$ showed that the methanation activity is a function of the average Ni thickness, reaching a maximum of about four times that of Ni (111) at a thickness of 5A. Substitution by deuterium results in no change in the methanation activity. On Ni(111), however, an inverse isotope effect was observed for the production of ethylene while on Ni/TiO_2, a normal isotope effect was observed. The magnitude of the effect is a function of temperature. The photochemical activity of TiO_2 in the photo-dissociation of water was examined in a specially constructed isolation cell with a sensitivity of 0.5 monolayer for hydrogen. We found that hydrogen can be produced via a thermally assisted process (significant only above 200°C, with an activation energy of 27 kcal/mole) and a photon-assisted process (with no activation energy). The H_2 photo-production rate is independent of the CO partial pressure but increases monotonically with water partial pressure. At low photon intensity, the reaction rate increases approximately linearly with photon intensity, but saturates as the photon flux increases. A kinetic model was proposed that explains all these observed features. A high resolution electron energy loss spectrometer was constructed with all the electronics, computer interface and control software. Preliminary tests showed that the combined system performs as designed. Such a spectrometer will be used for vibrational studies of molecules adsorbed on surfaces.

40365 **(PB—81-134793) Energy from biological processes. Volume III. Appendixes, Part C: Select conversion technologies and end use.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Sep 1980. 719p. NTIS, PC A99/MF A01.

This volume contains the following working papers written for OTA to assist in preparation of the report, Energy from Biological Processes: End Use of Fluids from Biomass as Energy Resources in Both Transportation and Nontransportaton Sectors; Thermochemical Conversion of Biomass: the Scientific Aspects; Engineering Aspects of Thermochemical Conversion; and Biological Production of Gas.

40366 **(PB—81-854937) Purox pyrolysis process. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 65p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the description, evaluation, and general and specific applications of the pollution free purox pyrolysis process for deriving fuels and chemicals from municipal, industrial, and agricultural wastes. There is some consideration of the environmental benefits of this process as well as the energy benefits. (Contains 54 citations, fully indexed and including a table of contents.)

40367 **Role of vitamin B_{12} in methyl transfer for methane biosynthesis by Methanosarcina barkeri.** Wood, J.M. (Univ. of Minnesota, Navarre); Moura, I.; Moura, J.J.G.; Santos, M.H.; Xavier, A.V.; LeGall, J.; Scandellari, M. *Science (Washington, D.C.);* **216**: 303-305(16 Apr 1982). Contract AS09-80ER10499.

When Methanosarcina barkeri is grown on methanol as the sole carbon source, a B_{12}-containing protein is synthesized by this organism. This B_{12}-protein contains bound aquocobalamin, and when this cofactor is reduced and methylated with [^{14}C]methyl iodide, the resultant [^{14}C]methyl B_{12} protein is extremely active in the biosynthesis of ^{14}C-labeled methane. These findings indicate that a B_{12}-dependent system is operative in the biological formation of methane in addition to other systems that are B_{12}-independent.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 40244, 40365, 40394, 40395, 40444, 40446, 40449, 40451, 41084

40368 **(DOE/RA/50313—1137) Feasibility study for a coal-sourced methanol project. Final report.** (Grace (W.R.) and Co., Dallas, TX (USA)). 29 Jan 1981. Contract FG01-80RA50313. 111p. NTIS, PC A06/MF A01. Order Number DE82008137.

In 1979, W.R. Grace & Co. began work with Energy Transition Corporation to assess the feasibility of constructing a coal-sourced methanol plant in the Axial Basin of northwest Colorado. These studies envisioned construction of a plant to produce 537 million gallons of methanol per year. However, it became clear that a plant of this size would have to capture an unrealistically large share of the early market available to it. Accordingly, Grace believes that the most promising project development strategy is to begin with an initial module producing about 67 million gallons of methanol per year. During 1981, Grace conducted a study of this concept at its own expense, which established the feasibility of this approach. Also during 1980, Grace received a grant from the Department of Energy primarily to assess the environmental impact and regulatory requirements of the project. In addition, this study updated the design basis and economics of the large plant. This report summarizes the results of the DOE-funded feasibility study. This report concludes that the environmental impacts of both the initial and expanded plants are acceptable, and that all regulatory requirements can be met. In summary, all the physical and technical resources for the project are fully in hand, and the environmental and regulatory risks are small. Engineering and financial analysis are sufficiently complete to conclude that the project is economically attractive. Market risks can be minimized by beginning with a small initial module, followed by plant expansions to serve a growing methanol market.

40369 **(PB—81-188914) Ethanol production in southwestern New York: technical and economic feasibility. Final report.** Kalter, R.J. (Cornell Univ., Ithaca, NY (USA)). Jan 1981. 313p. NTIS PC A14/MF A01.

The development of one or more centralized ethanol conversion facilities in the Southwestern portion of New York State is likely to be commercially feasible if either locally-produced cheese whey and/or imported corn are used as a feedstock. Development is shown to be highly profitable under a broad range of economic conditions and technical considerations. Four plant designs ranging in annual production capacity from 1.675 to 27.5 million gallons of ethanol (utilizing alternative feedstocks) are investigated. Although all are found to be economically viable, maximum profitability per unit production are obtained from a 2.5 million gallon plant using only whey. In all cases, a by-product in the form of animal feed is generated, which will result in additional revenue for the conversion facility. In the case of corn/whey plants it takes the form of a distillers dried grain. In the case of whey plants, it takes the form of a high-mineral, medium protein feed supplement for low and moderate producing dairy cattle. Both have a ready market in the region. Also the cheese whey is assumed to be deproteinized at the cheese manufacturing plant prior to delivery to an ethanol conversion plant to obtain a valuable, human-grade food protein.

40370 **(PB—82-103516) The role of solvent in aqueous-organic solvent delignification of southern yellow pine. Doctoral thesis.** Hansen, S.M. (Alabama Univ., University (USA). Bureau of Engineering Research). Jul 1981. 255p. NTIS, PC A12/MF A01.

The effects of solvents are studied in batch organic solvent delignification of Southern Yellow Pine. Organic solvent delignification is discussed and related literature is surveyed. Wood chips pulverized into meal were heated with solvents in a mechanical agitator. Predictive equations are derived from experimental data for yellow pine in new solvent systems. The effects of solvents on the swelling of wood are investigated, and the discovery of a relationship between volumetric swelling and bulk delignification is reported. A rate equation is developed to determine the percentage of lignin remaining at various times during the delignification process. Integration of this equation yields the same two-step curve which was observed in the delignification experiments. It was concluded that the mathematical models presented can predict first-step delignification results within 5 percent of experimental values and second-step delignification results within 12 percent of experimental values. For any solvent or wood type, the only parameters needed to describe bulk delignification results are the wood swelling parameters.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 40432, 40433

40371 **(EUR—6985-EN) Optimization of conditions for suspension firing of fuel-product concentrates.** Douglas, E.; Poll, J. (Warren Spring Lab., Stevenage (UK)). 1980. 54p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Portion of document are illegible.

Fuel concentrates extracted from domestic refuse (Refuse Drived Fuel - RDF) are now in commercial production and the investigation of their combustion characteristics when burned in suspension is the subject of this report. Practical problems in storage and feeding and their solutions are described together with details of the design of a test facility on which more than fifty firing trials have been completed. Problems with establishing stable self supporting ignition are described, the application of theoretical concepts to these problems is discussed. Areas requiring further investigation to establish the conditions which must be fulfilled to establish stable self-supporting combustion are indicated.

40372 **(PB—81-134777) Energy from biological processes. Volume III. Appendixes, Part A: Energy from wood.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Sep 1980. 387p. NTIS, PC A17/MF A01.

This working paper was written for OTA to assist in preparation of the report, Energy from Biological Processes. The purpose of the study is to inquire into the feasibility of fostering further substitution of wood for fossil fuels. It is the author's conclusion that there is a surplus of wood that could be used for fuel in substitution for fossil fuels, and, on a renewable basis, this supply could be very substantially increased if it were national policy to do so.

40373 **(PB—81-234601) Nation's unused wood offers vast potential energy and product benefits. Report to the Congress.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 3 Mar 1981. 128p. (EMD—81-6). NTIS, PC A07/MF A01.

This report illustrates that immense quantities of wood, which might be used as fuel or products, are wasted each year and that Federal policies are contributing to this loss potential. Recommendations to help eliminate this waste of valuable wood resources are given.

40374 **(PB—82-100868) Coal: DRDF (densified refuse derived fuel) demonstration test in an industrial spreader stoker boiler. Use of coal: DRDF blends in stoker-fired boilers. volume I. Final report.** Kleinhenz, N.J. (Systems Technology Corp., Xenia, OH (USA)). Sep 1981. Contract EPA-68-03-2426. 146p. NTIS, PC A07/MF A01.

This study program has the overall objective of evaluating boiler performance and environmental feasibility when combusting densified forms of refuse derived fuels (dRDF) blended with coal and fired in a modern industrial spreader stoker-fired boiler. The results reported herein represent the second phase of a two-phase evaluation program. Phase 1 was conducted in an institutional spreader stoker heating boiler. During Phase 1 285 tons of dRDF were combusted. The results of that test are reported in EPA Report No. 600/2-80-095. Phase 2 demonstration testing was conducted in a larger industrial spreader stoker boiler. In a period of 402 hours, 1702 tons of dRDF were co-fired with coal. An additional 231 hours of coal baseline testing was completed to provide a basis of comparison for the test results.

40375 **(PB—82-100876) Coal: DRDF (densified refuse derived fuel) demonstration test in an industrial spreader stoker boiler. Use of coal: DRDF blends in stoker-fired boilers, appendices A, B, C, and D. Volume II. Final report.** Kleinhenz, N.J. (Systems Technology Corp., Xenia, OH (USA)). Sep 1981. Contract EPA-68-03-2426. 250p. NTIS, PC A11/MF A01.

This study program has the overall objective of evaluating boiler performance and environmental feasibility when combusting densified forms of refuse derived fuels (dRDF) blended with coal and fired in a modern industrial spreader stoker-fired boiler. The results reported herein represent the second phase of a two-phase evaluation program. Phase 1 was conducted in an institutional spreader stoker heating boiler. During Phase 1 285 tons of dRDF were combusted. The results of that test are reported in EPA Report No. 600/2-80-095. Phase 2 demonstration testing was conducted in a larger industrial spreader stoker boiler. In a period of 402 hours, 1702 tons of dRDF were co-fired with coal. An additional 231 hours of coal baseline testing was completed to provide a basis of comparison for the test results.

40376 **(PB—82-101668) Fundamental considerations for preparing densified refuse derived fuel. Final report.** Trezek, G.J.; Savage, G.M.; Jones, D.B. (California Univ., Berkeley (USA). Dept. of Mechanical Engineering). Sep 1981. 59p. NTIS, PC A04/MF A01.

A series of pilot-scale tests were conducted to determine the effects of various parameters on the densification of refuse derived fuel (RDF). The experiments included a series of bench-scale experiments involving a single die arrangement, as well as larger-scale studies in which a commercial pellet mill was used. The bench-scale tests (tests in which the pellets were individually formed), were conducted both to provide data needed for an analysis of the basis dynamics of pellet formation and as an aid in the interpretation of results obtained with the pellet mill. The energy required to overcome die friction was studied independently of the energy consumed in material deformation and compression. By so doing, it became possible to determine the specific effects of die length, diameter, and taper. The results also suggested explanations for the excessive die wear, and for the decreasing energy requirements for increasing the mass throughput observed in commercial pellet mills.

40377 **(PB—82-103904) Densification of refuse-derived fuels: preparation, properties and systems for small communities. Final report.** Campbell, J.; Renard, M.L. (National Center for Resource Recovery, Inc., Washington, DC (USA)). Sep 1981. 163p. NTIS, PC A08/MF A01.

Densified refuse-derived fuel (d-RDF) is produced by compacting refuse-derived fuel (RDF) into agglomerated pieces sufficiently cohesive to sustain storage and handling. The use of this d-RDF product as a substitute for coal in spreader-stoker boilers is a developing resource recovery alternative. This report covers an investigation of the operation, performance and product characteristics of a waste shredding and densification subsystem for production of d-RDF from air-classified light fraction and provides a technical and economic evaluation of d-RDF facilities for small communities.

13 HYDRO ENERGY

1301 Resources And Availability

40378 **(AD-A—107173/7) Water, watts, and wilds hydropower and competing uses in New England. Final report.** (New England River Basins Commission, Boston, MA (USA)). Aug 1981. 186p. NTIS PC A09/MF A01.

This report concludes a three year Hydropower Expansion Study conducted by the New England River Basins Commission. Basic objectives of the study were: to assess the feasibility of developing hydropower facilities at existing dams and undeveloped sites throughout the New England region; to clarify competing use issues which arise from the competition between hydropower development and other uses of water resources, and to assess the likelihood that conflicts would arise from such competition; and to provide information and data which will facilitate either the avoidance or resolution of competing use conflicts. The key findings from the study are summarized.

1302 Site Geology And Meteorology

40379 **(AD-A—097752/0) Jackson Mills and Mine Falls Dams, Nashua, New Hampshire. Reconnaissance report, hydroelectric feasibility. Volume 1, Jackson Mills Dam.** (Corps of Engineers, Waltham, MA (USA). New England Div.). Dec 1979. 112p. NTIS PC A06/MF A01.

This study investigated hydroelectric development at Jackson Mills Dam in Nashua New Hampshire. Reinstallation of hydroelectric power at Jackson Mills Dam has been determined feasible. During the 1950's the region switched from hydroelectric power to oil, however because of dependence on expensive imported oil, new interest is aroused in the idea of returning to hydroelectric power. Four alternatives sites were evaluated during the study. The recommended alternative a power house at the southern abutment adjacent to the public library best met the evaluation criteria.

40380 **(AD-A—097753/8) Jackson Mills and Mine Falls Dams, Nashua, New Hampshire. Reconnaissance report, hydroelectric feasibility. Volume 2. Mine Falls Dam.** (Corps of Engineers, Waltham, MA (USA). New England Div.). Jan 1980. 144p. NTIS PC A07/MF A01.

This study investigated hydroelectric development at Mines Falls Dam in Nashua New Hampshire. Reinstallation of hydroelectric power at Mines Falls Dam has been determined feasible. Two hydroelectric development plans were looked at in detail: (1) hydroelectric development at the dam site, (2) development along the canal about one mile downstream of the dam. Development at the dam was determined to be the most practical and feasible as it would not disturb the delicate canal system.

40381 **(PB—81-182347) Hydropower potential of the New York State Barge Canal.** Goodman, A.S.; Brown, R.S. (Polytechnic Inst. of New York, Brooklyn (USA)). Sep 1980. 124p. NTIS PC A06/MF A01.

The New York State Barge Canal System is a comprehensive, multi-purpose water resource. One of the several purposes of this resource is the generation of hydropower. This study defines the physical characteristics of the canal system as they relate to hydropower development. The hydropower potential of the canal system was determined, including an inventory of existing and proposed hydropower plants. The remaining unrealized potential of the canal system was then evaluated. Various sites were selected for further investigation on the basis of the unrealized potential of the barge canal system. The remainder of this study involved preliminary estimates of the engineering and economic feasibility of developing hydropower at these sites.

1304 Regulations And Licensing

40382 **(PB—81-854135) Low-head hydroelectric power financial and legal incentives. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 95p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning legal, financial, and institutional obstacles and incentives to the development of low-head hydroelectric power in general at specific geographical locations. Fundamental economic issues in the development of small scale hydropower are included also. (Contains 87 citations, fully indexed and including a table of contents.)

1306 Environmental Aspects

REFER ALSO TO CITATION(S) 40825, 41455

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 40922

40383 (CONF-810832—, pp 2.13-2.15) **Solar Energy Education Project.** Boehm, T.A. (New York State Education Dept., Albany, NY). Feb 1982. NTIS, PC A17/MF A01. Contract AC01-77CS34039.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Through a series of teacher training and writing workshops, the project produced a reader of articles on solar energy, a background text on solar applications, and 83 classroom activities on solar energy for science, industrial arts, home economics, social studies, and the humanities. More than two hundred workshops have been held, run by project staff, teachers trained and supplied by the project, resource agents of the regional solar centers, and the project's DOE program officer. Over 12,000 teachers, administrators, and parents have been exposed to solar energy concepts. Over forty thousand booklets of solar energy activities have been distributed.

40384 (CONF-810832—, pp 4.45-4.47) **Elementary school solar curriculum.** Lampert, S.; Wulf, K.; Yanow, G. (Univ. of Southern California, Los Angeles). Feb 1982. NTIS, PC A17/MF A01. Contract AS03-76SF00013;AT03-77CS32575.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40385 **(NASA-TM—76177) Growian 2 for more wind power and first European solar farm inaugurated.** (National Aeronautics and Space Administration, Washington, DC (USA)). Oct 1980. 4p. NTIS PC A02/MF A01.

A wind power installation with a power of five megawatts to be used in the Federal Republic of Germany is described. The first European solar farm was inaugurated in Madrid, and its operation is discussed.

40386 **(SSEC/SP—33141) 1980 solar update. Summary report.** (Southern Solar Energy Center Planning Project, Atlanta, GA (USA)). Aug 1980. Contract AC02-79CS30166. 38p. NTIS, PC A03/MF A01. Order Number DE82009566.

The 1980 Southern Regional Solar Update included presentations on institutional programs, detailed results of solar applications, technology workshops, and discussions on future solar directions. Titles of papers are listed that were presented in the Federal Program Review, Southern Solar Energy Center/State Program Review, Public Comment & Discussion Session, and Presentations on Local Activities, and each session is briefly summarized. (LEW)

1401 Resources And Availability

40387 **(EUR—7299-DE) Determination of global radiation from use of satellite data.** Raschke, E.; Moser, W. (Koeln Univ. (Germany, F.R.)). 1981. 30p. (In German). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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During the last 18 months methods for the determination of global radiation using measurements of the radiation reflected by the earth-atmosphere system have been developed. Several results are presented of radiative transfer calculations which have been done to examine the reflection, absorption and transmittance properties of realistic model atmospheres. The preprocessing of large amounts of satellite image data (image windowing, image rectification) is described. Both, radiative transfer calculations and image preprocessing, is needed for the implementation of a routine determining global radiation from satellite image data in the next R & D Solar Energy Program of the EC in 1980 and 1981.

40388 **(EUR—7306-EN) Selection method for production of test reference years. Final report, short version.** Lund, H.; Eidorff, S. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). 1981. 56p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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A Test Reference Year (TRY) is a collection of weather data for a specified location and for one year, arranged as 8760 sets of simultanious weather parameters. TRYs are used as input data for computer simulations of the all-year performance of solar energy systems and heating and cooling loads of buildings. They must contain as hourly data at least: Dry bulb temperature, global, diffuse and direct normal radiation, and wind velocity. Until now, TRYs have most often beem compiled of real, measured weather data in the true sequence within each month. This work has compared three methods for the selection of proper months, typical for the location. It is shown that all three methods render useable results, and the choice of the method is therefore mainly decided as the cheapest (in labour and computer expenses) in the selection process. It is further shown that a TRY gives only small reductions in the extremes, compared with the multiple year period from which the TRY is selected, e.g. 2 to 3% for heating and cooling loads corresponding to the 1% fractiles, and appr. 5% for the 0.05% fractiles, averaged for 8 combinations of selection methods and locations of weather data.

40389 **(EUR—7311-EN) Selection methods for production of test reference years.** Pilatte, A.; Nicolas, P. (Faculte Polytechnique de Mons (Belgium)). 1981. 62p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The aim of the research programme is to select from many years of meteorological observations a method for producing a test reference year to be applied to produce test reference years for the various climatic zones of Europe. A test reference year is a collection of weather data for one year, arranged as 8760 sets of simultaneous hourly weather parameters; it is delivered on a data carrier suitable for computer treatment, the main application being for computer simulation of all year performance of solar systems. They contain as a minimum the following hourly data: dry bulb temperature, global, diffuse and direct normal solar radiation and wind velocity. The research programme consisted in selecting a method for producing test reference years. Using long term observation data for Belgium (18 years) three reference years have been selected using 3 methods: a Belgian, a Danish and a Japanese one, the characteristics of which being that the first one is a purely mathematical one, the second one is partly mathematical and partly manual, requiring the help of an experienced meteorologist, and the third one using a completely different concept i.e., comparing the effect of the weather data on a given system and selecting the months of the reference year by mean of this comparison instead of working directly on the weather data themselves. Each of these test reference years has been evaluated by comparing its effects to the long term mean effects on a solar heating system. This evaluation has been

made in Mons not only for the 3 Belgian reference years but also for the 3 reference years selected by the Danish participant for his country. The result of this evaluation has been the adoption of the purely mathematical method of selection. It can be used any time to produce a library of test reference years for Europe provided long term weather data are available.

40390 **(EUR—7316-EN) Climatology of solar irradiance on inclined surfaces: I. Final report.** Slob, W.H.; Brethouwer, D.E.; den Ouden, C. (Technisch Physische Dienst TNO-TH, Delft (Netherlands)). 1981. 81p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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In Cabauw (51.966 N, 4.93 E) in the Netherlands, the following data were measured from March, 1979 till October, 1979: the global solar irradiance on planes at 12 different orientations, the direct solar irradiance on a surface perpendicular to the sunbeam, and the ground reflected solar irradiance. The data are presented in the form of hourly, daily and monthly totals as well as in frequency distributions. A comparison between sunshine duration with a Campbell Stokes and the direct solar radiation measured with a pyrheliometer is made. Hourly turbidity factors (Linke) were calculated for hours with direct solar radiation larger than 140 W/m^2. For 16 clear days with average Linke turbidity factors between 2.5 and 7.0 the measured diffuse sky irradiance for 12 different orientations was compared with the calculated irradiances from 2 models. Both model have good results at Linke turbudity factors around 6. For smaller turbidity factors the model given by Liebelt and Bodmann shows good results on the vertical surfaces and the surfaces facing the sun, but overestimates the irradiance on the horizontal surface. The model given by Dogniaux underestimates at most of the orientations but has good results on the horizontal surface.

40391 **(EUR—7375-EN) Development of discrete and continuous spectral measurements of global solar radiation. Final report.** Burtin, B.; Carels, R.; Crommelynck, D.; Dogniaux, R. (Institut Royal Meteorologique de Belgique, Brussels). 1981. 82p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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The research programme consists of two parts: to develop an equipment for continuous measurements of the spectral irradiance within 8 discreet bands of the solar radiation spectrum between 300 and 1000 nm, and to assure intermittent measurements of the spectral distribution of the solar global radiation in the same spectral range. A set of 8 spectral pyranometers associated with a data acquisition and integrator system has been built and assembled to realize an observation system for continuous records. A modified version of the spectral pyranometer has been developed and calibrated. A monochromator equipped with an optical fiber and a diffuser has been adapted to record easily spectrograms of the global radiation for specific weather conditions (clear sky and uniform overcast sky). Special care has been borne on the calibration procedure as well for the pyranometers as for the spectrophotometer. Since December 1979, records with spectropyranometers centred on 315 - 400 - 450 - 550 - 650 - 730 - 830 - 930 nm are operational on an half hourly basis of irradiation. Spectrophotometric records are carried out for specific weather conditions.

1403 Economics

REFER ALSO TO CITATION(S) 40431, 40520, 40908

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 40912

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 40341, 40345, 40346, 40349, 40365, 40370, 40372, 40457, 40710, 40916, 41003, 41117, 41156, 41157, 41158, 41161, 41206, 41207, 41469, 41532

40392 **(AD-A—098257/9) Testing of solar photovoltaic arrays for utilization on marine aids to navigation.** Trenchard, S.E. (Coast Guard Research and Development Center, Groton, CT (USA)). Nov 1980. 72p. (CGR/DC—13/80). NTIS PC A04/MF A01.

In 1978, approximately 400 solar photovoltaic arrays were procured and placed at marine exposure facilities in Groton, Connecticut, and Fort Lauderdale, Florida. The arrays were measured quarterly to ascertain the effects of the marine environment on electrical performance. Concurrently, a screening test for photovoltaic arrays to be used in the marine environment was developed at the Coast Guard R and D Center. Identical panels to those on test at the exposure sites were run through the pressure, immersion, and temperature (PIT) screening test. Based on the marine environment exposure test and the PIT screening test recommendations are made on the constitutent materials and construction techniques of solar photovoltaic arrays that are most suited to use in the marine environment.

40393 **(AD-A—102895/0) Semiconductor technology program. Progress briefs. Report for January-March 1981.** Bullis, W.M. (National Engineering Lab. (NBS), Washington, DC (USA)). Jul 1981. 16p. (NBSIR—81-2230-2). NTIS, PC A02/MF A01.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices. Emphasis is placed on silicon and silicon-based devices. Highlighted activities include newly issued resistivity SRMs, characteristics of sulfur-related deep levels in silicon, photoluminescence of indium-doped silicon, effect of tertiary interferograms on Fourier transform spectroscopy, design information for a set of wafer optical line-width standards, modeling of short-channel MOS transistors, acoustic-emission testing of tape-bonded ICs, laser scanning of a solar cell test pattern, power loss of transistor leads during fast switching, and second breakdown and radiation effects in power MOS transistors. Brief descriptions of an upcoming linewidth measurement seminar and a survey of Federal IC processing facilities are given. In addition, recent publications and publications in press are listed. The report is not meant to be exhaustive; contacts for obtaining further information are listed.

40394 (ANL/CNSV-TM—95, pp 163-173) **Production of methanol from digester gas in waste treatment plants.** Rozenman, T. (PFR Energy Systems, Inc., Marina Del Ray, CA). Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

The potential of producing methanol from the methane gases emanating from anaerobic digesters in municipal waste treatment plants is described. The preparation method for methanol is briefly followed. The use of methanol as a replacement fuel for various combustion systems in vehicles and gas turbines is discussed. The issues pertaining to the economic viability and environmental and regulatory aspects are discussed. (MCW)

40395 **(CONF-820127—6) Unconventional anaerobic digester designs for improving methane yields from sea kelp.** Fannin, K.F.; Srivastava, V.J.; Chynoweth, D.P. (Institute of Gas Technology, Chicago, IL (USA)). 1982. 24p. Inst. of Gas Tech., 3424 South State Street, Chicago, IL 60616.

From 6. annual conference on energy from biomass wastes; Lake Buena Vista, FL, USA (25 Jan 1982).

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Studies were performed as part of an ongoing comprehensive research program to develop and optimize the anaerobic digestion process for producing methane from sea kelp (Macrocystis pyrifera). Laboratory-scale studies focused on digester design and

operating techniques applicable toward the goal of increasing methane yields and production rates over those observed in previous studies using conventional stirred tank reactors (STR). Two unconventional anaerobic digesters, an upflow solids reactor and a baffle flow reactor, were used to study the anaerobic digestion performance of kelp; both digesters permit solids retention times that are longer than the hydraulic retention times. The performance of the unconventional digesters was compared with that of the STR on the basis of methane yield and process stability. These studies demonstrated that, although digester performance was markedly affected by kelp variability, the methane yield in both unconventional digesters exceeded 70% of the theoretical yield and was substantialy higher than that of the STR. Utilization of simple digester designs that promoted long solids retention times improved the anaerobic digester performance significantly over that observed in conventional anaerobic digestion processes.

40396 **(CONF-820127—8) Biogasification of woody biomass.** Jerger, D.E.; Conrad, J.R.; Fannin, K.F.; Chynoweth, D.P. (Institute of Gas Technology, Chicago, IL (USA)). 1982. 27p. Inst. of Gas Tech., 3424 South State Street, Chicago, IL 60616.

From 6. annual conference on energy from biomass wastes; Lake Buena Vista, FL, USA (25 Jan 1982).

Studies were initiated to determine the potential of land biomass for the production of methane by biological gasification. Six woody species were subjected to proximate and ultimate analyses and were evaluated for their biogasification potential by semicontinuous and batch-fed anaerobic digester studies in the presence and absence of excess nitrogen and phosphorus. A simple batch bioassay was also used to estimate anaerobic biodegradability. Semicontinuous-fed anaerobic digester studies with woody feedstocks under baseline conditions resulted in methane yields less than 1 SCF/lb VS added. With the addition of excess nutrients, increases were observed in the methane yields for all woody species; however, the yields were still below 1 SCF/lb VS added. Longer solids retention times resulted in a substantital increase in methane yields. Batch-fed anaerobic digester studies (60 to 120 day incubation period) were performed to compare the biodegradability of the feeds with that of semicontinuous-fed digester experiments. These studies resulted in methane yields greater than 3 SCF/lb VS added for four of the six species and approached 5 SCF/lb VS added for hybrid poplar. The high methane yields obtained in these studies resulted from increased solids retention times, which appear to be technically and economically feasible due to the low moisture content of the woody feeds. These methane yields compare favorably with results obtained from biomass species containing much lower lignin concentrations and, to our knowledge, represent the highest yields reported from woody biomass.

40397 **(DOE/JPL/954355—81-20) Large-area silicon sheet by EFG. Fourth quarterly report, October 1, 1981-December 31, 1981.** (Mobil Tyco Solar Energy Corp., Waltham, MA (USA)). 22 Feb 1982. Contract NAS-7-100-954355. 29p. NTIS, PC A03/MF A01. Order Number DE82008676.

The 1982 goals for the program of development of the growth performance and quality of 10 cm wide EFG ribbon in single cartridge furnaces have essentially been achieved. Optimization work has improved growth conditions at the target speed of 4 cm/minute to a level where growth can be sustained over periods of an hour or more. Ribbon flatness has been improved, stress and buckling levels reduced, and satisfactory thickness uniformity at the desired thickness of 200 μm achieved at this speed. A significant increase of cell efficiency to the range of 11 to 12% (AM1 and AR coated) has been demonstrated on large areas (50 cm^2) for ribbon grown with cold shoes at 3.5 cm/minute. The best cells, at 11.7% efficiency, are just short of the goal of 12% for this year. These results have been obtained in a new design of the 10 cm cartridge incorporating a lengthened linear cooling plate and ribbon exit gas seal for ambient control purposes. A new 10 cm cartridge system has been developed, capable of growth up to speeds of 2.8 cm/minute without the conventional design of cold shoe. This design uses end cold shoes to provide cooling at the ribbon edges only, and will be used to help evaluate the effect of cold shoes on ribbon quality. Annealing experiments on as-grown ribbon have been started to examine the influence of different annealing ambients, temperatures and times on SPV diffusion length of ribbon grown under varying conditions. All work on the program on multiple ribbon furnaces was discontinued as of the beginning of this quarter, and this effort has now been taken over by Mobil Tyco in its entirety.

40398 (DOE/SR/10702—2, pp 16p, Paper 1) **Improving tree growth on poor and medium sites through the use of legumes.** Jorgensen, J.R. 1982. NTIS, PC A04/MF A01. Contract AI09-80SR10702.

In Improving tree growth on poor and medium sites through the use of legumes. Part 1, Part 2, and Part 3. Annual report, September 1, 1980-August 31, 1981.

In the spring of 1980 the study was established near Aiken, SC, to determine if site quality could be improved by increasing N supply and rate of nutrient cycling through the use of N-fixing plants and moderate amounts of fertilizers. Kobe, virgatea, bicolor, and sericea lespedezas, in conjunction with P and K fertilization, were established on two areas planted to loblolly or sand pines. In the fall of 1982, at the end of the second growing season, sufficient numbers of N-fixing plants were established for good stand development. There was, however, a difference in lespedeza biomass due to species and to the area on which they were planted. Lespedeza biomass production was least for kobe and virgata and greatest for bicolor, with sericea intermediate. More biomass was produced on the moderate loblolly site than on the droughty sand pine site. On the droughty sand pine site weedy biomass on plots that received only P contained 23 kg of N/ha. Where bicolor was grown the biomass contained 134 kg of N/ha. The more moderate loblolly pine site contained more biomass, than did the droughty sand pine area. Weeds on P only plots contained 60 kg of N/ha. Biomass of plots seeded to bicolor contained 178 kg of N/ha. On both sites the majority of the difference between the N content of the weed and bicolor stand is believed due to biological N fixation.

40399 (DOE/SR/10702—2, pp 12p, Paper 2) **Influence of legumes and fertilization on sand pine site quality.** Jorgensen, J.R. 1982. NTIS, PC A04/MF A01. Contract AI09-80SR10702.

In Improving tree growth on poor and medium sites through the use of legumes. Part 1, Part 2, and Part 3. Annual report, September 1, 1980-August 31, 1981.

This study, located on the Savannah River Project, near Aiken, SC, is designed to determine if sand pine productivity on poor sites can be improved by simple treatments. Sand pine were planted in late February 1981, on plots that had been fertilized with 112 kg/ha of P as triple superphosphate or ground rock phosphate or no phosphorus. In March coated and uncoated sericea lespedeza seed were sown on disked and undisked areas. In late July there were 146 and 112 sericea plants/m^2 on disked and undisked areas, respectively. Form of P fertilizer had no effect on the number of plants, but no P fertilizer resulted in reduced populations. Coated seed produced stands that were superior to those obtained from uncoated seed. A combination of disking and sowing coated seed produced the densest stands. Neither coating nor fertilizer affected lespedeza stand height. Plants on disked plots were 26 cm tall compared to 20 cm tall on undisked areas.

40400 (DOE/SR/10702—2, pp 28p, Paper 3) **Effect of seeding and site preparation practices on the establishment of sericea.** Jorgensen, J.R. 1982. NTIS, PC A04/MF A01. Contract AI09-80SR10702.

In Improving tree growth on poor and medium sites through the use of legumes. Part 1, Part 2, and Part 3. Annual report, September 1, 1980-August 31, 1981.

To examine alternatives to agronomic recommendations, five experimental areas were located on the Savannah River Project, Aiken, SC, in the spring of 1981. Soils ranged from deep sands to sandy loams with clay subsoils. Seedbed preparation varied from site to site, with the maximum preparation being windrowing, disking, rootraking, and disking to control hardwood sprouts with a final disking to prepare a seedbed and incorporate fertilizer. Minimum preparation consisted of leaving slash from the previously harvested trees where it fell. Intermediate treatments were several intensities of burning to remove slash and accumulated litter. Plots were fertilized with ground rock phosphate and triple superphosphate at rates of 0 and 112 kg of P per ha. Uncoated sericea lespe-

deza seed were sown at rates of 5.6, 11.2, and 22.4 kg/ha of actual seed. Seed were sown in late winter, early spring, and in the late spring of 1981. In late July 1981, the number of seedlings/m² and their heights were measured. Sowing seed on seedbeds produced by burning resulted in successful stand establishment, although more plants were obtained when disking preceded seed sowing. Legumes were not established on areas that received no site preparation. Adequate stands were often obtained when 5.6 kg of seed/ha were sown, but more uniform plant populations and larger numbers were obtained when 11.2 kg were used.

40401 **(EUR—6954-DE) Development of cadmium selenide thin film solar cell.** Bonnet, D.; Jaeger, K.H.; Luke, U. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). 1980. 87p. (In German). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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The first phase of the project aimed at developing a CdSe-MIS thinfilm solar cell has been completed. Experimental cells achieved efficiencies of 4.5 percent. Short-circuit current densities of more than 25 mA/cm², related to incident solar radiation of 100 mW/cm², and open-circuit voltages around 600 mV have been realized. Fourteen materials were studied with regard to their suitability as I-layers. Two of these compounds, i.e. ZnSe and Sb_2Se_3, were found to result in cells with relatively high photovoltage and high photocurrent. The preparation procedure for the 2- um thick active CdSe film was optimized with respect to all essential parameters. Commercial, nominally very pure CdSe material from six manufacturers was found either to be unsuited or to lead to properties greatly varying from batch to batch. The best results were reproducibly obtained with a material directly synthesized at Battelle from the elements which are commercially available in highly pure form. Further enhancement of the photovoltage up to 700 to 800 mV seems possible by suitable doping of the CdSe layer and compensation of the doping near the surface. This as well as an enhancement of the fill-factor from 55 to 70 percent will lead to cells of 9 to 10 percent efficiency.

40402 **(EUR—7013-EN) Optimization of silicon solar cells operating under medium-range solar concentration (20 to 50). Final report.** Fabre, E. (Laboratoires d'Electronique et de Physique Appliquee (LEP), 94 - Limeil-Brevannes (France)). 1982. 47p. (In French). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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The results are presented of a one year study on the optimization of silicon solar cells intended to be operated under medium range solar concentration (20 to 50). We first pose the problem of the solar concentration and we show the importance of the series resistance and the necessity of an overall optimization which takes all the parameters into account. The technological process for making the optimized cells is then described, together with a detailed analysis of the different contributions to the series resistance. We show that the three main contributions are the resistance along the lines of the grid of the front contact, the resistance of the base material and the sheed resistance in the diffused layer. The optimized solar cells that we have made at the end of this study present a lumped series resistance smaller than 20 m Ω for a 2 x 2 cm² area, and the three main contributions are roughly the same. Such a cell exhibits a conversion efficiency of about 13.5% under AM1 (illuminated area, according to ERDA specifications). The possibility of increasing again the conversion efficiency through a further reduction of the series resistance is discussed. Measurements of the conversion efficiency of optimized cells are under way.

40403 **(EUR—7014-EN) Alternative thin-film solar cells.** Pauwels, H. (Ghent Rijksuniversiteit (Belgium)). 1982. 22p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The influence of energy barriers and interface states at the junction on the efficiency of heterojunction solar cells is investigated in order to be able to identify optimum structures. To this general theory are added various generalizations: introduction of tunnelling through energy spikes, introduction of bulk states and of photon excitation in the space charge region, influence of an insulating layer. Finally, a systematic search in the thin film literature was performed to find the materials which would perform best in the optimum or near-optimum structures. (LEW)

40404 **(EUR—7016-EN) Study of factors affecting the reproducibility of CdS-Cu_2S solar cells and the development of new fabrication techniques. Final report.** Gasperd, A.; Moore, K.; Woods, J.; Hill, R. (International Research and Development Co. Ltd., Fossway (UK)). 1982. 123p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

As alternatives to the conventional vacuum deposition technique two methods of cadmium sulphide formation have been studied: (a) the anodic sulphurization of cadmium, and (b) radio frequency sputtering from a cadmium sulphide target. Both methods produced cadmium sulphide layers which, when processed into CdS-Cu_2S cells, yielded open circuit voltages of up to 350 mV. The efficiencies of these cells were, however, limited by the high resistivity of the cadmium sulphide layer. The effect on cell efficiency of impurities in the cadmium sulphide starting material has been investigated. It has been confirmed that cell efficiencies increase as the purity of the starting material is improved, but this improvement has not yet been associated with the removal of any single impurity or type of impurity. A CdS-Metal Insulator Semiconductor structure has been evaluated as a possible technique for determining the presence of interface states in the CdS-Cu_2S heterojunction. The stoichiometry of the copper sulphide layers has been determined by a study of the variation of resistivity with temperature, and this technique has been used to evaluate any copper vacancy reduction achieved by doping.

40405 **(EUR—7033-DE) Development of single crystal CdTe solar cell for terrestrial application, adapted for use in optical concentrators.** Jaeger, H.; Fuessl, B.; Seipp, E.; Thiel, R. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). 1981. 14p. (In German). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

During the first phase of the contract most of the work was done in order to optimize the most important structural elements of the solar cells, which were produced on the base of crystalline CdTe. Two approaches in development of such cells were made. In the first, n-CdTe crystals were covered with a p-type heterolayer as a window for sunlight; ZnTe was evaporated as a p-type layer. In the second, p-CdTe crystals were covered with a n-type heterolayer as a window. Here, CdS evaporation layers and indium-tin-oxide (ITO) sputtered layers were applied. Within the first approach the realization of ZnTe-layers simultaneously highly conductive and transparent was tried by using numerous dopants. Success finally was attained in July. Within the second approach, the development of p-CdTe/n-CdS solar cells, the resistances of the ohmic contacts on the back of the p-CdTe wafers were a major problem. We found some ways of preparing ohmic contacts of acceptable contact resistance, but an ideal problem solution is lacking still. We found a dependence of the contact resistance on the p-CdTe doping concentration. Solar cells made from p-CdTe crystals covered with nn^+-CdS attained on open circuit voltage of 655 mV and a short circuit current density of 13,8 mA/cm² in a 100 mW/cm² light. Assuming a sufficiently low series resistance we expect an efficiency of about 6 percent. Besides the $^+$-CdS layers n^+-ITO-layers (indium-tin-oxide) were deposited on p-CdTe by sputtering. These cells exhibit a short circuit density a little higher but a lower open circuit voltage than the heterosolarcells with n^+-CdS.

40406 **(EUR—7079-FR) Deposition of polycrystalline silicon layers from the melt on carbon substrates. Final report.** Belouet, C. (Laboratoires d'Electronique et de Physique Appliquee (LEP), 94 - Limeil-Brevannes (France)). 1981. 34p. (In French). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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The results are presented of a one year study on the deposition of polycrystalline silicon layers from the melt on carbon substrates. The analysis of the influence of the various variables relevant to the process is given together with the present achievements and the improvements planned. Deposition rates of 6 cm/mn on lengths up to 15 cm have been obtained with the first experimental set-up. The morphological characteristics and the performances of the layers are then described. It is shown that the size of the grains is relatively large (≧ 1 mm²) and the diffusion length of the minority carriers is above 20 μm. Finally the envisaged improvements which should yield higher conversion efficiencies of the cells (at present 6% for n^+/p structures under AM_1 illumination) are mentioned.

40407 **(EUR—7080-EN) Growth of silicon layers from the vapour phase on a liquid-metal layer.** Graef, M.W.M.; Bloem, J.; Giling, L.J.; Lensen, H.G.W.; Maes, J.W.C. (Katholieke Univ. Nijmegen (Netherlands)). 1981. 37p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

A method was developed for the growth of large-grain polycrystalline silicon on a tin-coated graphite substrate (Chemical vapour deposition on a liquid layer - CVDOLL process). The experimental conditions for optimum grain sizes were established; reproducible results were obtained under the circumstances 0.5% trichlorosilane and 1.0% hydrogen chloride in hydrogen at 1500 K substrate temperature. The thermodynamics of the Si-H-Cl system was studied, revealing the influence of the gas phase composition and temperature on the crystal surface morphology and the average grain size. Some electrical properties of doped p-type layers grown on tin-coated graphite were measured. The relation between the active carrier concentration (n/sub +/), the boron concentration in the solid (n/sub d/), and the average grain size (d) were determined experimentally, and could be fitted to a model in which grain boundaries are considered as trapping sites. As a conclusion the CVDOLL-grown layers can be considered as semicrystals, i.e. all defects can be assigned to grain boundaries. The results point out that p-type CVDOLL-grown silicon films are suitable as base layers in photovoltaic solar cells.

40408 **(EUR—7081-EN) Development process of silicon films obtained by rheotaxy on tinned sheet for solar cells.** Peccoud, L.; Boselli, A. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 1981. 28p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Boron-doped silicon layers have been deposited in a low pressure CVD apparatus at 50 torrs, by a rheotaxy epitaxial process on a tinned graphite substrate. In the same way, deposits have been obtained on Papyex graphite substrate. Investigations of the different CVD parameters which act on the Si growth have been shown that the critical ratio Cl/Si was 2 when silicon film was deposited at atmospheric pressure and 0.5 when deposited at 50 torrs indicating that the cinetic growth is different according to the pressure. Silicon layers deposited at 1100°C high rates (1 μm/min), Boron-doped 0.2 ohm-cm and a 50 μm thick give crystallites of 100 μm maximum with a slightly preferred (110) orientation. The first attempts to apply diffusion junction in two stages to some of the silicon films gave no significant results.

40409 **(EUR—7082-EN) Recrystallization of amorphous and small-grain-size polycrystalline silicon.** Schins, W.J.H.; Ouwens, C.D.; Bezemer, J.; Radelaar, S. (Rijksuniversiteit Utrecht (Netherlands)). 1981. 24p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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The recrystallization of fine grained polycrystalline silicon obtained by chemical vapour deposition (C.V.D) was investigated. C.V.D. grown polycrystalline silicon grains with sizes of 1 to 10 μm are either <110> textured or randomly oriented. Recrystallization of the highly textured material by heating for three hours at a few tenth of degrees below the melting point (1410°C) yields a great variety in grain size in the range of 0.2 to 1.0 mm. No influence on grain growth of large temperature gradients (up to 500°C/mm at 1300°C) was observed. From the dependence of the degree of recrystallization upon temperature and time activation energies for nucleation and grain growth can be deduced. In this context a distinction has to be made between recrystallization of fine grained areas and larger clusters of grains with very straight grain boundaries. Activation energy for growth of the finer grains is 4.7 eV whereas for growth of the clusters activation energies of 7.7 eV (normal to the straight boundaries) and 3.7 eV (parallel to the straight boundaries) can be calculated. New grains are elongated in the direction of growth of the starting material. Texture changes during recrystallization from a <110> to a <111> fiber texture. An improvement of homogeneity and simultaneously increase of average grain size is expected by means of etching with Cl_2 of HCl during recrystallization. Silicon layers from an aluminum-silicon melt (25% silicon) have large grains of more than 1 mm diameter. The measured mobility and restivity correspond to values as obtained for heavily aluminum doped single crystalline silicon (15 $cm^2V^{-1}sec^{-1}$ and 20mΩcm respectively). Solar cells made of these layers behave like a short circuit until now. Purification of the silicon layers will improve solar cells made of them.

40410 **(EUR—7083-EN) Development of low-cost cadmium sulphide sintered ceramic-ribbon solar cells for terrestrial applications. Final report.** (Planer (G.V.) Ltd., Sunbury on Thames, Middlesex (UK)). 1981. 51p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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Work is reported on the development of the basic production processes for the preparation of low cost cadmium sulfide sintered ceramic ribbon solar cells for terrestrial applications. After a brief summary of the necessary steps for the production of sintered CdS solar cell arrays, sources of cadmium sulfide are discussed, including that produced in-house and that produced commercially. Firing and doping of cadmium sulfide and the electrical properties of the material are discussed. The process of producing sintered ceramic CdS solar cells is then described in detail, step by step, from the production of compacted cadmium sulfide substrates, through sintering and junction formation, to electrode attachment. Some results are given of performance testing and of encapsulation and life testing. (LEW)

40411 **(EUR—7092-EN) Influence of surface structure and surface absorbates on solid-phase epitaxial growth.** Kistemaker, J.; Saris, F.W. (FOM-Instituut voor Atoom-en Molecuulfysica, Amsterdam (Netherlands)). 1981. 6p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

The epitaxial growth of layers of amorphous silicon on single crystals of silicon is investigated. Progress has been made by introducing the laser anneal process in place of the previously used thermal anneal process. The sample preparation method is described. Evaporated layers of silicon up to thicknesses of 2500 angstroms easily grew epitaxially on silicon single crystals. Potential applications of laser-annealing are listed, as are potential contributions of laser-annealing to reduce costs of solar cells. (LEW)

40412 **(EUR—7093-EN) Process of deposition of single-crystal silicon directly from the vapor phase. Final report.** Franzosi, A.; Giarda, L.; Pelosini, L.; Pizzini, S. (Montedison S.p.A., Novara (Italy). Ist. di Ricerche G. Donegani). 1981. 40p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

The direct growth of silicon single crystal bars from the gas phase by the CVD technique, using the conventional technologies for the polysilicon production, has been carried out to prepare silicon, for solar cell use in the short term. The influence of temperature, total gas flow rate, reaction mixture composition and cooling rate (after having completed the deposition) on the external habit, defect concentration and type, growth rate and electrical properties of silicon single crystal bars grown directly from the gas phase has been investigated. It has been demonstrated that the hexagonal habit, which is characteristic of the low temperature deposition, could be preserved also in the case of long deposition runs and that both the macroscopic defects known as chevron defects and the dislocation density could be controlled by a suitable choice pretreatment of the seed and of the operation conditions. It was shown

that the gas phase deposited single crystal bars exhibit reasonably good electrical properties which however depend both on the dislocation density and on chevron defects concentration. The profile temperature calculation, which has a parabolic distribution along the radius of the bar showed that crystal with a maximum 4 cm in diameter can be grown. After having established the technical feasibility of the methods (single crystal bar, 2 cm thick and 40 cm long with a very low density of macrodefects have been obtained) an economic analysis of the process was performed. The results obtained showed a substantial reduction cost with respect to the conventional CZ method, but comparable cost with the new very large or continuous ingot pulling technologies.

40413 **(EUR—7094-EN) Investigation on ion implantation as a technique suitable to fabricate high-efficiency silicon solar cells. Final report.** Soncini, G.; Zignani, F. (Consiglio Nazionale delle Ricerche, Bologna (Italy)). 1981. 29p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Potential advantages offered by ion implantation for fabricating low cost, high efficiency silicon solar cells are investigated. Theoretical and experimental doping profiles for thermally annealed layers implanted through silicon dioxide are compared. The influence of residual radiation damage on average lifetime and mobility of the n^+ front layer is examined, and the ion implanted back surface field is discussed. A low temperature process is defined for fabrication of ion implanted silicon solar cells which avoids base lifetime degradation. (LEW)

40414 **(EUR—7096-EN) I. Evaluation of thin Pd, Pt and Ni silicides Schottky barriers for silicon solar cells. II. Large-area uniform growth of Si layer by solid-phase epitaxy. Final report.** Canali, C. (Modena Univ. (Italy). Ist. di Fisica). 1981. 22p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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Stability and decomposition of PtSi, NiSi, and PdSi in contact with single crystal or amorphous Si is examined. PtSi, PdSi and NiSi are thermally stable both with Si, but are unstable in contact with metal film. It is shown that epitaxial Si layers can be obtained using both Pd and Al as metal film and layers can be electrically doped by the addition of a doping layer to the thin film structure prior to the heat treatment or by inclusion of Al atoms so that n^+ and p^+ conductivity can be achieved in the grown epilayer. The effects of impurities, substrate orientation on the growth kinetics are also discussed. (LEW)

40415 **(EUR—7447-EN) Solar energy programme of the Commission of the European Communities.** (Commission of the European Communities, Brussels (Belgium). Directorate General for Research, Science and Education). 1981. 277p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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The main results of the research program on energy from biomass and photochemical, photoelectrochemical, and photobiological processes carried out in the period 1978-1979 are presented. The biomass topics summarized are: potential land use, potential energy from biomass, straw, wood, gasification, and algae production and conversion. The other project topics covered are: photochemistry, biological hydrogen production in algae and bacteria, enzymes and their incorporation into matrices, and artificial systems. (MHR)

40416 **(EUR—7537-EN) Regional analysis of potential energy production from agricultural wastes: technical and economic study. Final report.** Have, H. (Kongelige Veterinaer-og Landbohoejskole, Copenhagen (Denmark). Jordbrugsteknisk Inst.). 1981. 155p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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The possibilities for utilization of agricultural wastes for energy production are analyzed in two Danish counties, Ringkoebing and Vestsjaelland, which have different agricultural production patterns. The quantitative analysis shows that the major waste products, surplus straw, waste wood and animal waste, in total with present technique can cover about 28% of the demand for heat energy (mostly space heating) in both counties. The potential coverage from straw, wood and animal waste is about 3, 3 and 22% in Ringkoebing and 18, 2 and 8% in Vestsjaelland respectively. A technical analysis indicates that direct combustion is the most favorable conversion method for straw and wood while biological conversion at present is best suited for animal waste. An economic analysis based on costs of collection, storage, transport and conversion of wastes and costs of corresponding oil and oil conversion were made. From a community point of view only straw and wood are found to be competitive to the expensive gas fuel oil when burned in automatically stoked furnaces. From a heating station point of view waste utilization is more attractive because of the sales tax on oil products. Here straw and wood are competitive fuels to both gas and heavy fuel oil in all the analyzed systems except from the small manually stoked furnaces. Animal waste seems to be competitive only when replacing gas fuel oil in medium size (500 kW) well utilized aerobic fermenters.

40417 **(EUR—7545-EN) Photovoltaic-module control-test specifications. Specification No. 501.** Krebs, K. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 44p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Test specifications are presented for photovoltaic module control tests of the Commission of the European Communities which shall be applied by the Joint Research Centre for the acceptance of prototype and production modules for pilot and demonstration projects of the Commission. The test schedule and a detailed description of 20 control tests are given. The purpose of these tests is to provide data on the performance rating of photovoltaic modules and to identify environmental factors and design features which could affect their durability.

40418 **(EUR—7550-EN) Assessment of how forest production currently not used would be obtained for energy purposes, and fron this an evaluation of management methods most appropriate to production of wood for energy purposes. Final report.** King, G.H. (Department of Energy, London (UK); Aberdeen Univ. (UK)). 1981. 159p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

For existing plantings and management, the availability of residues and energy in the forest and from the wood processing industry in the United Kingdom has been shown to be 885kt/y for 1977 and 2520kt/y for 2000. Biomass available in 2000 from thinning of existing forests is likely to range from 600kt/y up to much higher levels if the markets for small roundwood remain weak. Energy plantations of two types have been examined in detail, coppice for the better conditions, single stem growth for the more difficult sites. Suitable species have been evaluated, and areas of land which are at present only partially utilized for food production have been identified. Depending on the conditions, yields are likely to vary from 5 to 20 t/ha/y giving a potential yield of forest biomass of 16M dry t/y from 1.5M ha. Costs of biomass per uit energy, on-site, from residues, processing, thinnings and plantations are less than the current price of coal.

40419 **(EUR—7552-EN) Establishment of a permanently expressed hydrogenase in photosynthetic prokaryotes by means of genetic alteration and metabolic inhibition.** Carr, N.G.; Asato, Y. (Liverpool Univ. (UK)). 1981. 56p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Eight strains of filamentous, heterocyst-forming cyanobacteria surveyed in this study demonstrated varying degree in their hydrogen producing capacities. Maximal rates hydrogen evolution occured at optimal pH values of 7.5, 8.0, or 8.5 according to the strains analyzed. Further increases in the rates of hydrogen evolution were obtained by either increasing the light intensity (84-1500

microE/m³/s or by addition of inorganic (Na_2S) or organic substrates. Of the organic substrates tested, pyruvate was found to be most effective in enhancing hydrogen production. Analogues of glutamine, methionine sulfoxamine and hydroxylysine, permitted hydrogen production in the presence of repressible quantities of ammonium concentrations. Four of nine chlorate resistant mutants of Anabaena 7120 demonstrated increased rates of hydrogen evolution. The results of this study indicate that further survey and analysis of cyanobacteria with respect to hydrogen production should be made at optimal environmental conditions and that genetic mutants of efficient hydrogen producing strains could significantly increase the yield of hydrogen production.

40420 (EUR—7556-EN) **Photochemical, photoelectrochemical, and photobiological conversion.** Gerischer, H. (Max-Planck-Gesellschaft zur Foerderung der Wissenschaften e.V., Berlin (Germany, F.R.). Fritz-Haber-Institut). 1981. 54p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Attempts are reported to study and prevent photodecomposition of photoelectrodes. The thermodynamics of anodic photodecomposition is briefly discussed, using as an example an n-type binary compound semiconductor which may be oxidized by holes if illuminated in contact with an electrolyte. In particular, the stability of CdS and CdSe photoanodes in polychalcogenide redox systems is examined and found to be limited. Coatings of RuO_2 and of MoO/sub x/ are used to take over the photogenerated holes from the crystal and to let them pass, thus coupling the semiconductor to the redox processes in solution and suppressing the photodecomposition. An attempt was made to stabilize a CdSe/sulfide-polysulfide system by covering the electrodes with a thin layer of dye molecules which are polymerized to make them insoluble and that can act as scavengers for holes. The layered crystal MoS_2 was grown from molten salt solution, and n-type $MoSe_2$ and WSe_2 single crystals were grown from the vapor phase. The photoelectrochemical behavior of layered crystals was evaluated. Photoelectrochemical cells with n-$MoSe_2$ electrodes show relatively high efficiencies. (LEW)

40421 (EUR—7560-EN) **Algal biomasses. Final report.** Croatto, U. (Centro Studi ed Applicazioni delle Risorse Energetiche, Venice (Italy)). 1981. 27p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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The possibility or producing energy from algal biomass, spontaneously growing in lagoons and coastal ponds, has been considered. Those areas are distributed all along the coasts and particularly are present in deltas of big rivers, where drainage water from river basins and effluents from human and industrial settlements along the rivers themselves, produce a zero-cost fertilization. It has been found that phytoplanktonic productivity of lagoons and coastal ponds is very high not only because of high nutrient concentration but also for the warm temperature, the considerable oxygen content, and the no-turbulence of water. A detailed study of the Lagoon of Venice (500 km²) has allowed the finding the exploitable species, the estimate of their productivity, and the location of natural accumulation areas (accumulation factor up to 100 or more). Therefore harveting techniques for the accumulation areas only (without producing any ecological unbalance or disturbing any other human activity) have been tested. A preliminary estimate of the production costs has shown that they are comparable if not lower than those for artificial ponds.

40422 (EUR—7561-EN) **Feasibility study of short-rotation forestry for combined pulp and energy purposes and sparsely populated areas. Final report.** Van Veen, J.A.; Jansen, M.J.H.; Breteler, H.; Olie, J.J.; Frissel, M.J. (Association Euratom-ITAL, Wageningen (Netherlands)). 1981. 19p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The mean annual dry matter production of a short-rotation poplar forest was 14.4 ton ha^{-1} during a 5 year growing period. A nitrogen balance was made to estimate the need for nitrogen of the system. During the growing period trees took up 542 kg N ha^{-1} of which 64% is in bole and branches. In the 5th year denitrification was measured in undisturbed columns in the field using the acetylene-inhibition technique. An annual denitrification rate of 18 kg N ha^{-1} was estimated on the basis of the observed N_2O-profile. The system needed an annual input of 122 kg N ha^{-1} to balance the nitrogen budget. The energy balance showed that at the present dry matter production the system had a net output of 54 GJ ha^{-1} y^{-1}. An increase of the dry matter production to a maximum of 25 ton $ha^{-1}y^{-1}$, which seems possible when planting the trees at higher density, would raise the net energy output up to 96.7 GJ $ha^{-1}y^{-1}$, in spite of higher energy inputs associated with fertilizer applications. Although this study shows that, at the present level of dry matter production, short-rotation forestry is an energy producing system, both the dry matter production and the energy prices have to increase considerably to make the system economically feasible.

40423 (EUR—7564-EN) **Methane and compost from straw. Final report.** Rijkens, B.A. (Instituut voor Bewaring en Verwerking van Landbouwprodukten, Wageningen (Netherlands)). 1982. 14p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

A concept is developed in which the farmer collects the straw and ferments it anaerobically to compost and methane at the farm. The methane can be used for heating and for production of mechanical energy, while the compost can be returned to the land at any suitable moment. This way of processing conserves part of the energy, present in the straw, that would otherwise be lost by the field-burning or the ploughing-in. In the meantime it solves the field-burning and environmental problems and it provides the possibility to recycle the organic matter in the humus, as well as all the fertilizing compounds K, P, Mg and nitrogen. There are indications that the arable land will need a restocking with humus that has been lost during many years of (modern) farming, leading to loss in structure and production capacity. This study collects the global technical and economical data, enabling us to indicate under which circumstances and local conditions the methane and compost concept would be feasible and would be an alternative to field-burning, ploughing-in or to the purely energetic use of the straw.

40424 (EUR—7570-EN) **Energy from marine biomass: methane production by mariculture on land.** Wagener, K. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). 1981. 40p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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A system for biofuel farming in coastal deserts is presently under investigation in a cooperative European project. The biomass production is based on seawater which is pumped through shallow artificial ponds. Due to the high productivity of phytoplankton, easy fermentation to methane, and complete mineral nutrients recycling, the net energy balance (output/input) is expected to be 14 for methane and 7 for methanol, respectively. Since no fertile land or fresh water is needed, there is no competition with food production on arable land. Such a system is entirely energy self contained, what makes it attractive for remote desert areas and developing countries. During the first two years of collaboration on this project the feasibility of all crucial steps could be demonstrated: productivities of 60 - 90 t dry matter $hectare^{-1}$ y^{-1} obtained in southern Italy, a cheap way of pond construction, harvesting, fermentation, and recycling of the sludge. A pilot plant is under construction.

40425 (EUR—7592-EN) **Mutual orientation of pigments in photosystem I particles from green plants.** Junge, W.; Schaffernicht, H.; Nelson, N. (Technische Univ. Berlin (Germany, F.R.). Max-Volmer-Inst. fuer Physikalische Chemie und Molekularbiologie). 1981. 25p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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The mutual orientation of pigments in photosystem I reaction centers from spinach is evaluated by polarized photochemistry. The photoinduced linear dichroism of the absorption changes of chlorophyll-a/sub I/ at 701 nm is studied as function of the excitation wavelength. The photosystem I reaction center particles contain about 100 and if depleted about 40 chlorophylls, respectively. To prevent their rapid Brownian rotation they were immobilized on DEAE sephadex. The excitation spectrum of the linear dichroism reveals a high degree of order between the long axis of β-carotene and the Q/sub y/ transition moments of those chlorophyll-a molecules absorbing at the red end of the spectrum. The latter are the most endangered ones for destructive oxidation via their triplet state. Hence, the location of β-carotene in close proximity to and in parallel with these chlorophylls seems to be most favorable for the protective role of β-carotene within the antennae system I. It is observed that the dichroic ratio of the absorption change of chlorophyll-a/sub I/ does not exceed a figure of 4/3, which characterizes a circularly degenerate system, even at excitation at 724 nm. This excitation selectively hits the few chlorophyll-a molecules absorbing at about 700 nm (including the photooxidizable dimer). Therefore, it is concluded that, the dimer is either composed of two chlorophyll-a molecules with their y-axes perpendicular, or, if these are in parallel, there is another pair absorbing at the same wavelength with its y axes perpendicular to those of the oxidizable dimer.

40426 **(EUR—7594-EN) Energy recovery by gasification of agricultural and forestry wastes in a co-current moving-bed reactor. Final report.** (Technische Hogeschool Twente, Enschede (Netherlands). Lab. of Chemical Reaction Engineering). 1981. 122p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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Five papers are included. A separate abstract was prepared for each paper. (MHR)

40427 (EUR—7594-EN, pp 17-28) **Gasification of solid waste potential and application of co-current moving bed gasifiers.** 1981. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

In Energy recovery by gasification of agricultural and forestry wastes in a co-current moving-bed reactor. Final report.

A short review is given on gasification processes for solid fuels with special emphasis on waste gasification. It is shown that although the co-current moving bed gasifier has not been under consideration for a long time, it offers interesting possibilities for waste gasification. The co-current gasification is described on basis of recently designed pilot plants and some operation data is given. Potential application is elucidated with an example, i.e. gasification of agricultural waste (maize cobs) in the rural areas of Tanzania.

40428 (EUR—7594-EN, pp 29-35) **Gasification of char particles with CO_2 and H_2O.** 1981. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

In Energy recovery by gasification of agricultural and forestry wastes in a co-current moving-bed reactor. Final report.

Gasification of large char particles with CO_2 and H_2O has been investigated both experimentally and with model studies. A local volumetric rate model is derived that takes into account the chemical reaction rate and the effective diffusivity being a function of the local carbon conversion and therefore a function of time and position within the particle. The model includes shrinking unreacted core and homogeneous reaction as extreme cases. Chemical reaction rates of powdered deal wood char were measured for different CO_2 and/or H_2O concentrations (0.05 to 2 mol/m^3) and as a function of the carbon conversion and temperature (1073 to 1273 K) by means of a modified thermobalance. In separate single particle tests the effective diffusivity has been determined for different carbon conversions. A specially designed single particle reactor has been used for local carbon conversion measurement within 0.04 m particles. Carbon conversion profiles obtained differ from those predicted by the shrinking core and homogeneous reaction extremes but could be very well explained by the local volumetric rate model. As an example results obtained from a 3 kg/h co-current moving bed wood gasifier are presented. Char conversion, particle diameter and temperature profiles agree well with the reduction zone model based on the local volumetric-rate particle model.

40429 (EUR—7594-EN, pp 36-61) **Co-current moving bed gasifier, simulation and experiments.** 1981. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

In Energy recovery by gasification of agricultural and forestry wastes in a co-current moving-bed reactor. Final report.

In the co-current moving bed gasifier the solid fuel successively dries, pyrolyses, reacts with oxygen while the remaining char is converted with carbon dioxide and steam. In the present simulation model the first three processes have been combined and described with mass and energy balances only. The modelling of the moving char bed reacting with CO_2 and H_2O is based on the local volumetric rate particle model. This particle model describes the influence of the changing effective diffusivity and reaction rate on the conversion rate and allows for the shrinking of the particle. The last effect governs the moving of the char bed. The model formulation is completed with equations for the gas velocity, interphase heat and mass transfer, and heat and mass balances for both phases. The model is capable of describing five possible process limitations (heat transfer, mass transfer, diffusion, chemical reaction and chemical equilibrium) occurring in the gasification process. In our pilot plant for the gasification of small woodblocks profiles have been measured for the char particle diameter, conversion, and for the gas composition and temperature. Although the comparison of the experimental and calculated profiles is complicated, it is concluded that the simulation model describes the gasification process well. Particle models with shrinking core or homogeneous reaction cannot describe the profiles found.

40430 (EUR—7594-EN, pp 62-73) **Design of co-current moving bed gasifiers fueled by biomass.** 1981. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

In Energy recovery by gasification of agricultural and forestry wastes in a co-current moving-bed reactor. Final report.

The gasification of wood varying in particle size and moisture content was studied utilizing models for different parts of the gasifier. From this analysis existing empirical design rules and process limitations can be understood and an improved design suitable for many types of biomass and wastes has been derived.

40431 (EUR—7594-EN, pp 74-89) **Social and economical aspects of the introduction of gasification technology in the rural areas in developing countries E.G. Tanzania.** 1981. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

In Energy recovery by gasification of agricultural and forestry wastes in a co-current moving-bed reactor. Final report.

To identify the social and economic advantages of the gasification process a study has been made of its applicability in rural areas of Tanzania. The evaluation included the selection of a suitable feedstock, the macro- and micro-economical effects and the fitting into the existing social-cultural system.

40432 **(EUR—7686-EN) Energy production from straw.** Strehler, A.; Hofstetter, E.M.; Heins, F. (Technische Univ. Muenchen, Freising (Germany, F.R.). Bayerische Landesanstalt fuer Landtechnik Weihenstephan). 1982. 320p. (In German and English). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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Most of the investigation and development of this research project had the aim of developing an adequate technology. The definition of such combustion technology quantities as calorific value, specific volume of flue gas, chemical composition, contents of volatile compounds and pure coke was the basis of the work. Besides, the correlation between the calorific value and conditions of storage and moisture contents was defined. The testing and evalua-

tion of different straw combustion systems represented an essential part of the research work. Some development resulted in a furnace with automatic feeding of fuel as chopped wood and straw. Various systems of untying bales and fuel supply were checked. The different possibilities of chopping straw were tried out in action. The possibilities of gasifying straw were checked. Another study dealt with the issue of energy production from straw, from the electrification of the single farm up to a straw power plant for 50 MW. One study investigates the energy demand and the possibilities of energy supply with straw and wood waste, in order to work out proposals for some regions.

40433 **(EUR—73538-EN) Handling and storage of chopped straw for heating purposes. Final report.** Persson, K.; Have, H. (Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark). Jordbrugsteknisk Inst.). 1981. 79p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The present work comprises (1) investigations on the effect of crushing, vibration and drifting on storage densities of chopped straw and (2) design, development and test of equipment for haulage, store handling and stoking of chopped straw.

40434 **(LBL—14017) Progress in the characterization of the products of direct liquefaction of Douglas fir.** Schaleger, L.L.; Davis, H.G. (Lawrence Berkeley Lab., CA (USA)). Feb 1982. Contract W-7405-ENG-48. 16p. (CONF-820232—1). NTIS, PC A02/MF A01. Order Number DE82008426.

From Canadian biomass liquefaction research group meeting; Saskatoon, Saskatchewan, Canada (16 Feb 1982).

Oils or tars produced by direct liquefaction of slurries of partially hydrolyzed Douglas fir in water have been quantitatively separated into nine distinct fractions by column chromatography using a modified SESC (sequential elution by solvents-chromatography) procedure. Molecular weight distributions of individual fractions and of whole oils have been obtained by high performance size exclusion chromatography (HPSEC). The predominant functional groups of each fraction have been identified by infrared spectroscopy. This information provides sensible chemical profiles of oil quality. Such profiles have been obtained for the organic products of some ten runs of LBL's continuous benchscale liquefaction unit as well as for several oils produced at DOE's PDU at Albany, Oregon. Comparison among the various wood oils reveals differences not previously recognized. The significance of these observations will be discussed. Aqueous effluent co-produced with wood-derived oil in the LBL process has also been examined. Reverse-phase and ion-exchange high performance liquid chromatography (HPLC) have been used to separate, identify and quantitate the major water-solubles-formic, acetic and glycolic acids.

40435 **(NASA-CASE-LEW—12892-1) Heat transparent high intensity high efficiency solar cell.** Evans, J.C., Jr. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). May 1981. 13p. NTIS PC A02/MF A01.

A heat transparent high intensity solar cell with improved efficiency is described. The surface of each solar cell has a plurality of grooves. Each groove has a vertical face and a slanted face that is covered by a reflecting metal. Light rays are reflected from the slanted face through the vertical face where they traverse a photovoltaic junction. As the light rays travel to the slanted face of an adjacent groove, they again traverse the junction. The underside of the reflecting coating directs the light rays toward the opposite surface of solar cell as they traverse the junction again. When the light rays travel through the solar cell and reach the saw toothed grooves on the under side, the process of reflection and repeatedly traversing the junction again takes place. The light rays ultimately emerge from the solar cell. These solar cells are particularly useful at very high levels of insolation because the infrared or heat radiation passes through the cells without being appreciably absorbed to heat the cell. NASA

40436 **(NASA-CR—164553) 17th project integration meeting.** Mcdonald, R.R. (Jet Propulsion Lab., Pasadena, CA (USA)). Feb 1981. 508p. NTIS PC A22/MF A01.

Progress made by the Low-Cost Solar Array Project during the period September 1980 to February 1981 is described. Included are reports on project analysis and integration technology development in silicon material, large-area silicon sheet and encapsulation production process and equipment development engineering, and operations. A report on and copies of visual presentations made at the Project Integration Meeting held at Pasadena, California on February 4 and 5, 1981 are also included.

40437 **(NASA-CR—164618) Silicon solar cell process development, fabrication, and analysis.** Yoo, H.I.; Iles, P.A.; Leung, D.C. (Jet Propulsion Lab., Pasadena, CA (USA)). Dec 1980. 54p. NTIS PC A04/MF A01.

Solar cells from HEM, Dendritic Webs, and EFG ribbons were fabricated and characterized. The HEM solar cells showed only slight enhancement in cell performance after gettering steps (diffusion glass) were added. Dendritic webs from various growth runs indicated that performance of solar cells made from the webs was not as good as that of the conventional CZ cells. The EFG ribbons grown in CO ambient showed significant improvement in silicon quality.

40438 **(NASA-CR—164622) Silicon materials task of the low-cost solar array project. Phase 4. Effects of impurities and processing on silicon solar cells.** Hopkins, R.H.; Hanes, M.H.; Davis, J.R.; Rohatgi, A.; Rai-Choudhury, P.; Mollenkopf, H.C. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Apr 1981. 68p. NTIS PC A04/MF A01.

The effects of impurities, various thermochemical processes, and any impurity-process interactions upon the performance of terrestrial solar cells are defined. The results form a basis for silicon producers, wafer manufacturers, and cell fabricators to develop appropriate cost benefit relationships for the use of less pure, less costly solar grade silicon.

40439 **(NASA-CR—164623) Large area sheet task: advanced dendritic web growth development.** Duncan, C.S.; Seidensticker, R.G.; Mchugh, J.P.; Hopkins, R.H.; Meier, D.; Schruben, J. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Apr 1981. 40p. NTIS PC A03/MF A01.

A melt level control system was implemented to provide stepless silicon feed rates from zero to rates exactly matching the silicon consumed during web growth. Bench tests of the unit were successfully completed and the system mounted in a web furnace for operational verification. Tests of long term temperature drift correction techniques were made; web width monitoring seems most appropriate for feedback purposes. A system to program the initiation of the web growth cycle was successfully tested. A low cost temperature controller was tested which functions as well as units four times as expensive.

40440 **(NASA-CR—164624) Low cost solar array project production process and equipment task: a Module Experimental Process System Development Unit (MEPSDU).** (Westinghouse Electric Corp., Pittsburgh, PA (USA)). May 1981. 44p. NTIS PC A03/MF A01.

Several major modifications were made to the design presented at the PDR. The frame was deleted in favor of a frameless design which will provide a substantially improved cell packing factor. Potential shaded cell damage resulting from operation into a short circuit can be eliminated by a change in the cell series/parallel electrical interconnect configuration. The baseline process sequence defined for the MEPSON was refined and equipment design and specification work was completed. SAMICS cost analysis work accelerated, format A's were prepared and computer simulations completed. Design work on the automated cell interconnect station was focused on bond technique selection experiments.

40441 **(NASA-CR—164626) Investigation of the hydrogenation of $SiCl_4$. Final report, 31 Mar 1979 - 1 Apr 1981.** Mui, J.Y.P.; Seyferth, D. (Massachusetts Inst. of Tech., Cambridge (USA)). Apr 1981. 123p. NTIS PC A06/MF A01.

A laboratory scale pressure reactor was constructed to study the 3 SiCl + $2H_2$ + Si yields 4 $SiHCl_3$ reaction at pressures up to 500 psig. Reaction kinetic measurements were carried out as a function of reactor pressure, reaction temperature and $H_2/SiCl_4$ feed ratio. Based on the reaction kinetic data, the hydroclorination of $SiCl_4$ and m.g. silicon metal is found to be an efficient process to produce $SiHCl_3$ in good conversions and in high yields. Copper is an effective catalyst. Results of the corrosion study show that conventional nickel chromium alloys are suitable material of construction for the hydrochlorination reactor. The hydrochlorination reaction is relatively insensitive to external process parameters such as silicon particle size distribution and the impurities in the m.g. silicon metal.

40442 **(NASA-CR—165475) Testing of solar cell covers and encapsulants conducted in a simulated space environment. Final report.** Russell, D.A. (Boeing Co., Seattle, WA (USA)). Nov 1981. 267p. NTIS, PC A12/MF A01.

The materials included in the evaluation were 0211 microsheet, FEP-A used as a cover and as an adhesive, DC 93-500 adhesive, PFA hard coat used as a cover, GE 615/UV-24 used as a cover, GR 650 used as a cover, and electrostatically bonded 7070 glass. The test environments were 1 MeV electron irradiation interspersed with thermal cycling, 0.5 MeV proton irradiation interspersed with thermal cycling and UV exposure interspersed with thermal cycling. Summary data is given describing the response of the test materials both visually and electrically to the three different environments.

40443 **(NASA-TM—82656) Comparative radiation testing of solar cells for the Shuttle power extension package.** Baraona, C.R.; Swartz, C.K.; Hart, R.E., Jr. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1981. 4p. NTIS PC A02/MFA01.

The Power Extension Package (PEP) is the prime focus of a development program to produce low cost solar cells. The PEP is a 32 kilowatt flexible substrate, retrievable, solar array system for use on the Space Shuttle. Solar cell cost will be reduced by increasing cell area and simplifying cell and coverglass fabrication processes and specifications. The cost goal is to produce cells below $30 per watt. Two and ten ohm-cm silicon cells were investigated. This paper describes a unique radiation damage test and side-by-side comparison of candidate cell types with pre-and post-irradiation airplane calibration of outer space short-circuit current.

40444 **(PB—81-134769) Energy from biological processes. Volume II. Technical and environmental analyses. Report OTA-E-128.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Sep 1980. 228p. NTIS, PC A11/MF A01.

This volume presents the technical and environmental analyses on which the conclusions in Volume I are based. Part I: Biomass Resource Base, includes: forestry, agriculture, processing wastes, and various unconventional sources including oil-bearing and aquatic plants. Part II: Conversion Technologies and End Uses, considers thermochemical conversions, fermentation for ethanol production, anaerobic digestion, use of alcohol fuels, select energy balances, and a brief description of chemicals from biomass. In each case, appropriate technical, economic, and environmental details are presented and analyzed.

40445 **(PB—81-134785) Energy from biological processes. Volume III. Appendixes, Part B: Agriculture, unconventional crops, and select biomass wastes.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Sep 1980. 856p. NTIS, PC A99/MF A01.

This volume contains the following working papers written for OTA to assist in preparation of the report, Energy from Biological Processes: The Potential of Producing Energy From Agriculture; Cropland Availability for Biomass Production; Energy From Agriculture: Unconventional Crops; Energy From Aquaculture Biomass Systems: Fresh and Brackish Water Aquatic Plants; Energy From Agriculture: Animal Wastes; and Energy From Agriculture: Agricultural Processing Wastes.

40446 **(PB—81-206344) Bioconversion of lignocellulosics. Progress report for 1976.** Kirk, T.K. (Forest Products Lab., Madison, WI (USA); Forest Service, Madison, WI (USA). Forest Products Lab.). 15 Aug 1976. 16p. NTIS, PC A02/MF A01.

New methods are being examined for the chemical processing of lignocellulosics in order to increase the world supply of food and energy. This research is focused on both enzymatic and microbial conversions. Twenty-seven strains of Phanerochaete chrysosporium were examined for biodelignification and biodemethylation. Problems with selectivity were encountered and results were quite variable, but indications that xylose increases selectivity were obtained. Preliminary results suggested that bioalterability of industrial lignins may be accomplished. Other preliminary indications suggest that Clostridium thermocellum may provide a source of industrial cellulase for implementation in other cellulosic bioconversion processes as well as fermentation of these materials to methane, ethanol, and acetate.

40447 **(PB—81-230567) Potential for energy farming in the Dominican Republic: a preliminary analysis. Final report February-May 1980.** Trehan, R.K.; Newman, L.; Park, W.R. (Mitre Corp., McLean, VA (USA). METREK Div.). May 1980. 103p. (MTR—80W105-SPANISH). NTIS, PC A06/MF A01.

40448 **(PB—82-100546) Biomass energy conversion: ecological, economic, and social constraints. Final report.** Pimentel, D. (New York State Coll. of Agriculture and Life Sciences, Ithaca (USA)). Jan 1977. 21p. NTIS, PC A02/MF A01.

Development of substitute energy sources in lieu of non-renewable fossil fuels was addressed. The study was based on the projection that by the turn of the century almost half of the world's oil, gas, and coal resources will be consumed. In this study, an analysis was made of biomass energy conversion and its ecological, social, economic, and energy constraints. Estimates of the total biomass in the United States that could be utilized in energy production were presented. Biomass sources considered were feed processing wastes, crop remains, animal wastes, forestry wastes, fuel-wood production, brown-kelp farming, and water hyacinth. For the analysis, two methods were examined for converting biomass into useful forms of energy--incineration and biogas production. Results indicated that use of these methods could reduce the nation's dependence upon fossil fuels by about five percent. Prime difficulties identified in the use of biomass for solar energy conversion were the (1) small percentage of light energy converted into biomass by plants; (2) low concentration of biomass per unit of land and water; and (3) high moisture content making collection and transport expensive and energy conversion inefficient. Suggestions were made to prevent harmful consequences to the environment from biomass conversion. Effects on the nation's labor force and related social problems were considered.

40449 **(PB—82-854068) Biomass conversion from agricultural sources. January, 1976-October, 1981 (citations from the Energy Data Base). Report for Jan 76-Oct 81.** (National Technical Information Service, Springfield, VA (USA)). Oct 1981. 170p. NTIS PC N01/MF N01.

Reports on the economics, feasibility, and methods for biomass conversion from agricultural wastes, e.g., crop residues and animal wastes, into gaseous and liquid fuel energy sources are cited in this bibliography. (This updated bibliography contains 153 citations, 74 of which are new entries to the previous edition.)

40450 **(SERI/PR—8143-1-T6) Development of copper sulfide/cadmium sulfide thin-film solar cells.** Szedon, J.R.; Biter, W.J.; Dickey, H.C. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Mar 1982. Contract AC02-77CH00178. 52p. NTIS, PC A04/MF A01. Order Number DE82009398.

Unencapsulated thin-film solar cells of the Cu_2S/CdS type have been aged in controlled flowing-gas ambients to characterize changes in their photovoltaic properties. Severe degradation occurring in wet O_2 ambients at room temperature probably accounts for

the large short-circuit current losses reported earlier. Limited loss (<15% of initial values) in J/sub sc/ occurs at RT in dry oxygen. No loss can be attributed to moisture in Ar or N_2 ambients for exposure times greater than ~ 2 hrs. Direct measurements of optical absorption in the front Cu_xS layer would be facilitated by an integral CdS/Cu_xS detector on the back surface. Several techniques for making such a detector were successfully demonstrated.

40451 (SERI/SP—290-1467) Large-scale alcohol fuels plants directory. Adams, A. (comp.). (Solar Energy Research Inst., Golden, CO (USA)). Feb 1982. Contract AC02-77CH00178. 114p. NTIS, PC A06/MF A01. Order Number DE82009119.

Ethanol and methanol plants in the United States producing producing at least 100,000 gallons per year were surveyed. Plants in the planning or construction stages as well as those in operation were surveyed. A total of 299 plants from 44 states were included. Plants are listed in the directory according to location, by state and then city. If a city for the plant has not yet been selected, the plant will be listed at the beginning of its state. If a state has not been selcted, the plant will appear at the front of the directory. Such plants are labeled Site Not Selected. The plants are indexed by by-products, capacity, company, and feedstock.

40452 (SERI/TR—98133-1A) Cultivation of macroscopic marine algae and fresh water aquatic weeds. Ryther, J.H. (Solar Energy Research Inst., Golden, CO (USA); Woods Hole Oceanographic Institution, MA (USA)). Feb 1982. Contract AC02-77CH00178. 150p. NTIS, PC A07/MF A01. Order Number DE82008391.

The ORCA clone of the red seaweed Gracilaria tikvahiae has been in culture continuously for over two years. Yield for the past year has averaged 12 g ash-free dry wt/m^2 .day (17.5 t/a.y) in suspended 2600-l aluminum tank cultures with four exchanges of enriched seawater per day and continuous aeration. Yields from nonintensive pond-bottom culture, similar to commercial Gracilaria culture methods in Taiwan, averaged 3 g afdw/m^2.day in preliminary experiments. Rope and spray cultures were not successful. Yields of water hyacinths from March 1978 to March 1979 averaged 25 g afdw/m^2.day (37 t/a.y). Season, nutrient availability (form and quantity) and stand density were found to affect the relative proportions of structural and nonstructural tissue in water hyacinths and thereby significantly affect digestibility of and methane production by the plants. Pennywort (Hydrocotyle) grew poorly in winter and its annual yield averaged only one-third that of water hyacinth. Water lettuce (Pistia) appears more comparable to hyacinths in preliminary studies and its yields will be monitored throughout a complete year. Stable, continuous anaerobic digestion of both water hyacinths and Gracilaria has been maintained with an average gas production from both species of 0.4 1/g volatile solids at 60% methane.

40453 (SERI/TR—98133-1B) Biomass production, anaerobic digestion, and nutrient recycling of small benthic or floating seaweeds. Ryther, J.H. (Solar Energy Research Inst., Golden, CO (USA); Woods Hole Oceanographic Institution, MA (USA)). Feb 1982. Contract AC02-77CH00178. 45p. NTIS, PC A03/MF A01. Order Number DE82009172.

A number of experiments have been carried out supporting the development of a seaweed-based ocean energy farm. Beginning in 1976, forty-two species of seaweed indigenous to the coastal waters of Central Florida were screened for high biomass yields in intensive culture. Gracilaria tikvahiae achieved the highest annual yield of 34.8 g dry wt/m^2 day. Yield has been found to vary inversely with seawater exchange rate, apparently because of carbon dioxide limitation at low exchange rates. Gracilaria was anaerobically digested in 120 liter and 2 liter reactors. Gas yields in the large digesters averaged 0.4 1/g volatile solids (.24 1 CH_4/gv.s.) with a bioconversion efficiency of 48%. Studies of the suitability of digester residue as a nutrient source for growing Gracilaria have been conducted. Nitrogen recycling efficiency from harvested plant through liquid digestion residue to harvested plant approached 75%. Studies of nutrient uptake and storage by Gracilaria, Ascophyllum, and Sargassum showed that nutrient starved plants are capable of rapidly assimilating and storing inorganic nutrients which may be used later for growth when no nutrients are present in the medium. A shallow water seaweed farm was proposed which would produce methane from harvested seaweed and use digester residues as a concentrated source of nutrients for periodic fertilizations.

40454 (TVA—2902256) Biomass estimates of eastern redcedar tree components. Schnell, R.L. (Tennessee Valley Authority, Norris (USA). Div. of Forestry, Fisheries and Wildlife Development). Feb 1976. 20p. (TN-B—15). NTIS, PC A02/MF A01. Order Number DE82902256.

Component parts (leaves, twigs, branches, etc.) of 31 eastern redcedar trees in two Tennessee Valley locations were cut and weighed. Wood and bark samples were oven-dried to determine moisture content and to establish dry bark and wood weights. Ratios of bark to wood for various components were calculated. Stump weights were taken at a manufacturing plant; the stumps were old and mostly heartwood. Findings indicate that about 60% of the redcedar tree (above the stump) is in the merchantable stem, 30% in branches, and 10% in leaves.

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40455 (BMFT-FB-T—79-143) Experimental study to define developments for terrestrial solar cell generators. Final report. Gochermann, H.; Pschunder, W.; Wahl, G. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Wedel (Germany, F.R.)). 1979. 144p. NTIS, PC A07/MF A01.

Materials, industrial processes, and design configurations were analyzed in order to define an economically attractive photovoltaic solar generator. System analyses and tests were performed, interconnection and encapsulation techniques for solar cells were developed, and a 1 kW solar generator was built for performance measurements. Special solar cells were developed and fabricated, using single crystalline silicon and unconventional polycrystalline silicon. Cost reductions through the use of large area wafers and from the modification of process steps for solar cell fabrication are demonstrated. Further cost reduction is shown possible by using cheaper materials for contacts, interconnectors, encapsulation, etc. Using the fabricated prototype cells, two types of solar cell modules, i.e., glass and plastic encapsulations were developed, favoring the modular design of solar generators. Accelerated life test results for solar cell aging characteristics along with generator operational electrical data are given.

40456 (CONF-820106—6) Startup experience with a concentrating photovoltaic power system. Kaplan, S.I. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 16p. NTIS, PC A02/MF A01. Order Number DE82008833.

From 20. aerospace science conference; Orlando, FL, USA (11 Jan 1982).

The startup testing of a solar photovoltaic power system located at Mississippi County Community College, Blytheville, Arkansas is examined. A review of problems encountered and methods of investigation are included, as well as assessments of the underlying causes and remedial action accomplished. The observed power output capacity and plausible levels of future improvement are also discussed.

40457 (DOE/ET/20272—152) Materials, processes, and testing laboratory technical progress report, March-June 1981. Forman, S.E.; Themelis, M.P. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 15 Aug 1981. Contract AC02-76ET20279. 33p. NTIS, PC A03/MF A01. Order Number DE82009178.

Specific details are presented for site visits where electrically failed modules were found and replaced at Mead, Nebraska and Bryan, Ohio. Broken interconnects at all test sites were reported and analyzed. A search for electrically failed modules at the Systems Test Facility (STF) array field was reported and analyzed. Several photovoltaic/thermal modules were analyzed for specific defects. (LEW)

40458 **(DOE/ET/29359—1) Investigation of a family of power conditioners integrated into a utility grid, Phase II. Period covered: January 1, 1981 to December 31, 1981.** Wood, P. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 1981. Contract AC02-79ET29359. 82p. NTIS, PC A05/MF A01. Order Number DE82008334.

Category II, intermediate size, power conditioners for solar photovoltaic (SPV) arrays in the range 30 kW to 600 kW are investigated. These systems interface with three-phase utility distributions at low voltage, below 1000 V. It is concluded that a family of designs based on the programmed-wave voltage-sourced dc-to-ac converter will best serve the needs of the application. The designs are modular in nature, with a three-phase six-pulse bridge as the basic power circuit building block. Two bridge designs, at 30 kW and 150 kW rating, are needed to cover the range. State-of-the-art baseline designs use impulse-commutated thyristor bridges with front-end dc-to-dc converters. They cannot meet cost goals, by quite a margin, or efficiency goals, though they are much closer to the latter than the former. Advanced concept designs use gate turn-off devices (GTOs) for the lower power range. These nearly meet the long range efficiency goals, but fail to meet long range cost goals. The higher power units are still thyristor based. Sufficiently large GTOs are not yet available at a reasonable price, nor are they expected to be for quite some time. When large GTOs do enter the marketplace, they can be substituted for thyristors in the 100 kW to 600 kW range with some cost and efficiency gains; however, the thyristors designs meet both long range cost and efficiency goals. In both power ranges, the advanced designs dispense with a dc-to-dc converter and use a multi-pattern programmed-wave approach as opposed to the fixed pattern, regulated dc link approach of the baseline designs. This technique, by avoiding processing the power twice, is largely responsible for the cost and efficiency gains observed.

40459 **(NASA-CR—3375) Satellite power systems (SPS). LSST systems and integration task for SPS flight test article. Final report.** Greenberg, H.S. (Rockwell International Corp., Downey, CA (USA). Satellite Systems Div.). Feb 1981. 142p. NTIS PC A07/MF A01.

This research activity emphasizes the systems definition and resulting structural requirements for the primary structure of two potential SPS large space structure test articles. These test articles represent potential steps in the SPS research and technology development.

40460 **(NASA-CR—3392) Satellite power study (SPS) concept definition study (exhibit D). Volume 1: executive summary. Final report.** Hanley, G.M. (Rockwell International Corp., Downey, CA (USA). Satellite Systems Div.). Mar 1981. 50p. NTIS PC A03/MF A01.

Efforts concentrated on updating of the Rockwell reference concept, definition of new system options, studies of special emphasis topics, further definition of the transportation system, and further program definition. The Rockwell reference satellite concept has a gallium arsenide (GaAs) solar cell array having flat concentrators with an effective concentration ratio of 1.83at end of life. Alternatives to this concept includes solid state power amplifiers or magnetrons for dc/RF conversion and multibandgap solar cells for solar to dc energy conversion. Two solid state concepts were studied. It was determined that the magnetron approach was the lowest mass and cost system.

40461 **(NASA-CR—3393) Satellite power system (SPS) concept definition study (Exhibit D). Volume 2: systems/subsystems analyses. Final report.** Hanley, G.M. (Rockwell International Corp., Downey, CA (USA). Satellite Systems Div.). 1981. 338p. NTIS, PC A15/MF A01.

Modifications to the reference concept were studied and the best approaches defined. The impact of the high efficiency multibandgap solar array on the reference concept design is considered. System trade studies for several solid state concepts, including the sandwich concept and a separate antenna/solar concept, are described. Two solid state concepts were selected and a design definition is presented for each. Magnetrons as an alternative to the reference klystrons for dc/rf conversion are evaluated. System definitions are presented for the preferred klystron and solid state concepts. Supporting systems are analyzed, with major analysis in the microwave, structures, and power distribution areas. Results of studies for thermal control, attitude control, stationkeeping, and details of a multibandgap solar cell study are included. Advanced laser concepts and the meteorological effects of a laser beam power transmission concept are considered.

40462 **(NASA-CR—3394) Satellite power systems (SPS) concept definition study (exhibit d). Volume 3: transportation analysis. Final report.** Hanley, G.M. (Rockwell International Corp., Downey, CA (USA). Satellite Systems Div.). Mar 1981. 85p. NTIS PC A05/MF A01.

Additional analyses and investigations were conducted to further define transportation system concepts that will be needed for the developmental and operational phases of an SPS program. To accomplish these objectives, transportation systems such as the Shuttle and its derivatives were identified new heavy lift launch vehicle (HLLV) concepts, cargo and personnel orbital transfer vehicles (EOTV and POTV), and intraorbit transfer vehicle (IOTV) concepts were evaluated and, to a limited degree, the program implications of their operations and costs were assessed. The results of these analyses were integrated into other elements of the overall SPS concept definition studies.

40463 **(NASA-CR—3395) Satellite power systems (SPS) concept definition study (exhibit d). Volume 4: operations analyses. Final report.** Hanley, G.M. (Rockwell International Corp., Downey, CA (USA). Satellite Systems Div.). Mar 1981. 103p. NTIS PC A06/MF A01.

Using a coplanar, end-mounted antenna as a baseline, various configuration trades were performed to select a preferred solid state concept. The increase in efficiency that could be realized by use of multi bandgap solar cells, either with klystron or solid state antenna was evaluated. Satellite configurations were developed to exploit the sandwich antenna concept wherein solar cells are located on one side of the antenna panel and solid state dc/RF converters on the other side. These concepts entailed various primary and secondary reflector arrangements for directing solar energy to the solar cell side of the antenna with higher concentration ratios than used on the coplanar configurations. Operations analysis included development of a satellite construction scenario, a concept for the SCB, a top-level satellite construction operation, construction operation, construction timelines and crew sizes, mass flows to orbit, and a satellite maintenance scenario. The list of materials required for satellite construction was updated to identify significant differences relevant to the solid state satellite concept. Means of decommissioning satellites at the end of their design life were studied.

40464 **(NASA-CR—3397) Satellite power systems (sps) concept definition study (Exhibit d). Volume 6, Part 1: cost and programmatics. Final report.** Hanley, G.M. (Rockwell International Corp., Downey, CA (USA). Satellite Systems Div.). 1981. 84p. NTIS, PC A05/MF A01.

A summary of the cost data reviewed as well as conclusions and recommendations are presented. Cost and programmatic aspects of Rockwell's SPS CR-2 reference configuration were based on the results of several contracts with NASA and independent company-sponsored activities by the Space Operations and Satellite Systems Division of Rockwell International.

40465 **(NASA-CR—3398) Satellite power systems (SPS) concept definition study (Exhibit D). Volume 4, Part 2: cost and programmatics appendix. Final report.** Hanley, G.M. (Rockwell International Corp., Downey, CA (USA). Satellite Systems Div.). Mar 1981. 401p. NTIS, PC A18/MF A01.

Cost and programmatic aspects of a recommended satellite power system are documented. Computer generated summaries are presented, and the detailed computer runs structured in a Work Breakdown Structure are given. The six configurations developed during the study period are summarized.

40466 **(NASA-CR—3400) Satellite power systems (SPS) concept definition study (Exhibit D). Solid-state amplifier investigation. Final report.** Hanley, G.M. (Rockwell International Corp., Downey, CA (USA). Satellite Systems Div.). Apr 1981. 102p. NTIS, PC A06/MF A01.

Data resulting from a continuing effort to provide system/subsystem definition data to aid in the evaluation of the SPS program concept is presented. The specific data described relate to the proposed use of solid state devices as microwave power amplifiers in the satellite microwave power transmission subsystem.

40467 **(NASA-CR—161813) Spectrophotovoltaic orbital power generation, Phase 2. Final report, Aug 1980 - Mar 1981.** Lo, S.K.; Stoltzman, D.; Knowles, G.; Lin, R. (Honeywell, Inc., Minneapolis, MN (USA). Systems and Research Center). Apr 1981. 107p. NTIS PC A06/MF A01.

A subscale model of the spectral splitting concentrator system with 10 aperture is defined and designed. The model is basically a scaled down version of Phase 1 design with an effective concentration ratio up to 1000:1. The system performance is predicted to be 21.5% for the 2 cell GaAs/Si system, and 20% for Si/GaAs at AM2 using realistic component efficiencies. Component cost of the model is projected in the $50K range. Component and system test plans are also detailed.

40468 **(NASA-RP—1076) Satellite power system: concept development and evaluation program. Volume 3: Power transmission and reception. Technical summary and assessment.** Dietz, R.H.; Arndt, G.D.; Seyl, J.W.; Leopold, L.; Kelley, J.S. (National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center). Jul 1981. 280p. NTIS PC A13/MF A01.

Efforts in the DOE/NASA concept development and evaluation program are discussed for the solar power satellite power transmission and reception system. A technical summary is provided together with a summary of system assessment activities. System options and system definition drivers are described. Major system assessment activities were in support of the reference system definition, solid state system studies, critical technology supporting investigations, and various system and subsystem tradeoffs. These activities are described together with reference system updates and alternative concepts for each of the subsystem areas. Conclusions reached as a result of the numerous analytical and experimental evaluations are presented. Remaining issues for a possible follow-on program are identified.

40469 (NASA-TM—84064, pp 234-240) **Theoretical study of microwave beam absorption by a rectenna.** Ott, J.H.; Rice, J.S.; Thorn, D.C. (Novar Electronics Corp., Barberton, OH). 1981. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The results of a theoretical study of microwave beam absorption by a Rectenna are given. Total absorption of the power beam is shown to be theoretically possible. Several improvements in the Rectenna design are indicated as a result of analytic modeling. The nature of Rectenna scattering and atmospheric effects are discussed.

40470 **(NASA-TM—84064) Workshop on microwave power transmission and reception. Workshop paper summaries.** (National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center). 1980. 1366p. NTIS, PC A99/MF A01.

Microwave systems performance and phase control are discussed. Component design and reliability are highlighted. The power amplifiers, radiating elements, rectennas, and solid state configurations are described. The proper sizing of microwave transmission systems is also discussed.

40471 (NASA-TM—84064, pp 1-12) **System performance conclusions.** Arndt, G.D. (NASA, Lyndon B. Johnson Space Center, Houston, TX). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

System sizing is discussed in terms of reduced power levels and antenna diameters smaller than 1 km. The microwave transmission efficiency for smaller SPS systems was investigated. Startup and shutdown operations were examined with emphasis on solar eclipse effects on the solar arrays. The antennas and subarray mechanical alignments are also discussed.

40472 (NASA-TM—84064, pp 14-23) **Sps large array simulation.** Rathjen, S.; Sperber, B.R.; Nalos, E.J. (Boeing Co., Seattle, WA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The computer programming efforts were directed primarily to beam pattern analysis. The computer programs used for simulation provide: verification of the reference design; definition of feasible departures such as quantized distributions; the study of far-out sidelobe roll-off characteristics; the analysis of errors and failures; illumination function analysis to develop beam patterns for efficient collection; and beam shaping synthesis to meet environmental constraints.

40473 (NASA-TM—84064, pp 26-31) **Active alignment scheme for the MPTS array.** Iwasaki, R. (Axiomatix, Los Angeles, CA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

In order to maximize the efficiency of the microwave power transmission system (MPTS), the surface of the array antenna must be extremely flat, which is difficult to achieve using passive techniques over the 1 km dimensions of the array. In order to achieve and maintain this required flatness, a rotating laser beam used for leveling applications on Earth was utilized as a reference system. A photoconductive sensor with a reflective collecting surface was used to determine the displacement and polarity of any misalignment and automatically engage a stepping motor to drive a variable-length mechanism to make the necessary corrections. Once aligned, little power is dissipated since a nulling bridge circuit that centers on the beam is used, an important alignment feature since even laser beams broaden considerably at 1 km distances.

40474 (NASA-TM—84064, pp 32-43) **Ionospheric power beam studies.** Duncan, L.M.; Gordon, W.E. (Rice Univ.). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

A power density level of 23 mW/sq cm is presented as a design specification based on theoretical calculations of a threshold for microwave ionosphere nonlinear interaction (thermal runaway). For comparable power densities, enhanced electron heating is observed to change the electron temperature by a factor of two or three, but not by an order of magnitude.

40475 (NASA-TM—84064, pp 44-54) **Proposed experimental studies for assessing ionospheric perturbations on SPS uplink pilot beam signal.** Basu, S.; Basu, S. (Emmanuel Coll., Boston, MA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The microwave beam of the proposed Solar Power Satellite (SPS) at geosynchronous altitude is to be formed and directed by phase information derived from a pilot signal at 2.45 GHz transmitted from ground and received in a number of module locations on the SPS antenna. The frequency of the pilot signal was chosen to be sufficiently low as to avoid the effects of strong scattering by turbulence in the neutral atmosphere and yet high enough to avoid any possible refractive effects caused by the ionized upper atmosphere. The propagation of the uplink pilot signal through the ionosphere which contains natural and possibly some artificial irregularities, was studied.

40476 (NASA-TM—84064, pp 58-74) **Performance analysis and simulation of the SPS reference phase control system.** Lindsey, W.C.; Chie, C.M. (LinCom Corp., Pasadena, CA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

Key results pertinent to the SPS reference phase control system design are summarized. These results are a consequence of extensive system engineering tradeoffs provided via mathematical modeling, optimization, analysis and the development/utilization of a computer simulation tool called SOLARSIM.

40477 (NASA-TM—84064, pp 75-84) **Design and breadboard evaluation of the SPS reference phase control system concept.** Hopkins, P.M.; Rao, V.R. (Lockheed Engineering and Management Services Co., Inc., Houston, TX). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

Efficient operation of a very large phased array such as the proposed solar power satellite, requires precision focusing and pointing of the power beam i.e., the power beam must have a planar wavefront directed precisely at the center of the target antenna (rectenna). To maintain such a power beam requires real-time phase compensation at each subaperture in order to adjust for structural deformations and other transitory factors. In the current solar power satellite (SPS) baseline, the spaceborne antenna (Spacetenna) is an active retrodirective array. A pilot signal transmitted from the center of the rectenna is phase-conjugated at each subaperture (power module) of the spacetenna, thereby assuring that the radiated composite wave is focused on the target. This scheme requires a large amount of precision electronic circuitry on the spacetenna. Specifically, pilot receivers must be located at each power module and an adaptive distribution network is required in order to provide a properly phased reference signal at each conjugator.

40478 (NASA-TM—84064, pp 85-94) **Coherent multiple tone technique for ground based SPS phase control.** Chie, C.M. (LinCom Corp., Pasadena, CA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The ground based phase control concept was studied as an alternative approach to the reference SPS phase control system. The details of the ground based phase control system study are documented. The coherent multiple tone technique used for the ground based phase measurement waveform design and phase control system is summarized.

40479 (NASA-TM—84064, pp 95-98) **Interferometer-based phase control system.** Ott, J.H.; Rice, J.S. (Novar Electronics Corp., Barberton, OH). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

A system for focusing and pointing the SPS power beam is discussed. The system is ground based and closed loop. One receiving antenna is required on Earth. A conventional uplink data channel transmits an 8-bit phase error correlation back to the SPS for sequential calibration of each power module. Beam pointing resolution is better than 140 meters at the Rectenna.

40480 (NASA-TM—84064, pp 97-99) **Sonic satellite power system microwave power transmission simulator.** Ott, J.H.; Rice, J.S. (Novar Electronics Corp., Barberton, OH). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

A simulator which generates and transmits a beam of audible sound energy mathematically similar to the SPS power beam is described. The simulator provides a laboratory means for analysis of ground based closed loop SPS phase control and of ionospheric effects on the SPS microwave power beam.

40481 (NASA-TM—84064, pp 100-109) **SPS phase control studies.** Lund, W.W.; Sperber, B.R.; Woodcock, G.R. (Boeing Co., Seattle, WA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

To properly point and form the SPS microwave power beam, the outputs of the power amplifiers in the transmitting array must be phased in a specific and coherent fashion. The purpose of the SPB phase control system is to bring this about reliably. A number of different phase control schemes were studied. The one selected for the SPS baseline system is a retrodirective CW phase that is distributed via fiber optics. The basis of this selection is relative technical simplicity and requisite assurance of success.

40482 (NASA-TM—84064, pp 110-114) **SPS fiber optic link assessment.** Lindsay, T.O.; Nalos, E.J. (Boeing Co., Seattle, WA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

Fiber optic technology was selected in the SPS baseline design to transmit a stable phase reference throughout the microwave array. Over a hundred thousand microwave modules are electronically steered by the phase reference signal to form the power beam at the ground receiving station. The initially selected IF distribution frequency of the phase reference signal was set at 980 MHz or a submultiple of it. Fiber optics offers some significant advantages in view of the SPS application. Optical transmission is highly immune to EMI/RFI, which is expected to be severe when considering the low distribution power. In addition, there will be savings in both mass, physical size, and potentially in cost.

40483 (NASA-TM—84064, pp 115-125) **Ionospheric effects in active retrodirective array and mitigating system design.** Nandi, A.K.; Tomita, C.Y. (Rockwell International Corp., Pittsburgh, PA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The operation of an active retrodirective array (ARA) in an ionospheric environment (that is either stationary or slowly-varying) was examined. The restrictions imposed on the pilot-signal structure as a result of such operation are analyzed. A 3-tone pilot beam system is defined which first estimates the total electron content along paths of interest and then utilizes this information to aid the phase conjugator so that correct beam pointing can be achieved.

40484 (NASA-TM—84064, pp 127-136) **High efficiency SPS klystron design.** Nalos, E.J. (Boeing Co., Seattle, WA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The most likely compact configuration to realize both high efficiency and high gain is a 5-6 cavity design focused by an electromagnet. An outline of a potential klystron configuration is given. The selected power output of 70 kW CW resulted from a maximum assumed operating voltage of 40 kV. The basic klystron efficiency cannot be expected to exceed 70-75% without collector depression. Although impressive gains were achieved in raising the basic efficiency from 50% to 70% or so with a multi-stage collector, the estimated efficiency improvement due to 5-stage collector at the 75% level is only about 8% resulting in an overall efficiency of about 83%.

40485 (NASA-TM—84064, pp 139-146) **Analytic investigation of efficiency and performance limits in klystron amplifiers using multidimensional computer programs multi-stage depressed collectors and thermionic cathode life studies.** Kosmahl, H.G. (NASA Lewis Research Center, Cleveland, OH). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

Due to complexity of the program which used a hydrodynamic, axially and radially deformable disk-ring model and the resulting long computing time only the output gap was investigated. Results from independent studies were used to initiate the starting conditions for the electrons and the RF voltage using our program. Although this method of computation is less exact than processing the entire klystron interaction in 3-dimensions it is shown that, for a confined flow focused throughout the penultimate cavity, radial velocities remain very small and the beam is highly laminar. It is concluded that possible errors resulting from treating only the output cavity in 3-D would remain small.

40486 (NASA-TM—84064, pp 147-155) **Adapting of the crossed-field directional amplifier to the requirements of the SPS.** Brown, W.C. (Raytheon Co., Waltham, MA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

Progress in adapting the crossed-field directional amplifier to the SPS is reviewed. Special emphasis is given to (1) recent developments in controlling the phase and amplitude of the microwave power output, (2) a received architecture for its placement in the subarray, and (3) recent developments in the critical pivotal areas of noise, potential cathode life, and efficiency.

40487 (NASA-TM—84064, pp HDRC) **SPS antenna element evaluation.** (Boeing Co., Seattle, WA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The SPS transmitting array requires an architecture which will provide a low weight, high efficiency and high structural rigidity. Waveguide slot arrays constitute the most desirable option. Consequently, such an array was chosen for the SPS. Waveguide slot arrays offer high efficiency, uniform illimination, and are fairly lightweight. Bandwidths of such arrays are narrow, typically 1/2-2%. Although this does not directly impact the SPS, which transmits power at a single frequency of 2.45 GHz, the narrow bandwidth does constrain the thermal and mechanical tolerances of the antenna. The purpose of this program is to better define the electronic aspects of an SPS specific waveguide slot array. The specific aims of the program are as follows: (1) to build a full-scale half-module, 10 stick, array, the design parameters for which are to be determined analytical considerations tempered by experimental data on a single slotted radiating stick; (2) to experimentally evaluate the completed array with respect to antenna pattern, impedance and return loss; and (3) to measure swept transmission amplitude and phase to provide a data base for design of a receiving antenna.

40488 (NASA-TM—84064, pp 167-177) **Resonant cavity radiator (RCR).** Schroeder, K.G.; Carlise, R.L.; Tomita, C.Y. (Rockwell International Corp., Pittsburgh, PA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The fundamental theory of MW antenna operation and basic array technology development status was used in the design of the 1-km diameter 5-Gw SPS microwave antenna. However, the aperture size and the high efficiency requirements make the MW antenna extremely complex. Studies show that the slotted waveguide array is one of the most efficient radiators for the antenna. Subsequent analyses show that the temperature interface between waveguides and dc-RF conversion tubes can cause severe thermal design problems on the array. An alternate design, the Resonant Cavity Radiator, is described here.

40489 (NASA-TM—84064, pp 180-187) **Evaluation of thick wall wave guide element.** Nalos, E.J. (Boeing Co., Seattle, WA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The SPS transmitting array requires an architecture which will provide a low weight, high efficiency and high structural rigidity. As noted above, waveguide slot arrays constitute the most desirable option. Consequently, such an array has been chosen for the SPS. Waveguide slot arrays offer high efficiency, uniform illumination, are are fairly lighweight. Bandwidths of such arrays are narrow, typically 1/2-2%. Although this does not directly impact the SPS, which transmits power at a single frequency of 2.45 GHz, the narrow bandwidth does constrain the thermal and mechanical tolerances of the antenna. The purpose of this program is to better define the electronic aspects of an SPS specific waveguide slot array. The specific aims of the program are as follows: (1) To build a full-scale half-module, 10 stick, array, the design parameters for which are to be determined by analytical considerations tempered by experimental data on a single slotted radiating stick, (2) To experimentally evaluate the completed array with respect to antenna pattern, impedance and return loss, and (3) To measure swept transmission amplitude and phase to provide a data base for design of a receiving antenna.

40490 (NASA-TM—84064, pp 188-190) **Method for precision forming of low-cost, thin-walled slotted waveguide arrays for the SPS.** Brown, W.C. (Raytheon Co., Waltham, MA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

A method for the precision-forming of thin-walled, slotted-waveguide arrays was devised. Models were constructed with temporary tools and evaluated. The application of the method to the SPS requirements is discussed.

40491 (NASA-TM—84064, pp 191-200) **Considerations for high accuracy radiation efficiency measurements for the solar power satellite (SPS) subarrays.** Kozakoff, D.J.; Schuchardt, J.M.; Ryan, C.E. (Georgia Inst. of Tech., Atlanta). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The relatively large apertures to be used in SPS, small half-power beamwidths, and the desire to accurately quantify antenna performance dictate the requirement for specialized measurements techniques. Objectives include the following: (1) For 10-meter square subarray panels, quantify considerations for measuring power in the transmit beam and radiation efficiency to + or - 1 percent (+ or - 0.04 dB) accuracy. (2) Evaluate measurement performance potential of far-field elevated and ground reflection ranges and near-field techniques. (3) Identify the state-of-the-art of critical components and/or unique facilities required. (4) Perform relative cost, complexity and performance tradeoffs for techniques capable of achieving accuracy objectives. the precision required by the techniques discussed below are not obtained by current methods which are capable of + or - 10 percent (+ or - dB) performance. In virtually every area associated with these planned measurements, advances in state-of-the-art are required.

40492 (NASA-TM—84064, pp 203-212) **History of the development of the rectenna.** Brown, W.C. (Raytheon Co., Waltham, MA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The history of the development of the rectenna is first reviewed through its early conceptual and developmental phases in which the Air Force and Raytheon Company were primarily involved. The intermediate period of development which involved NASA, Jet Propulsion Laboratory, and Raytheon is then reviewed. Some selective aspects of the current SPS rectenna development are examined.

40493 (NASA-TM—84064, pp 213-222) **Rectenna system design.** Woodcock, G.R.; Andryczyk, R.W. 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

Various rectenna system options are discussed. Among these are the half-wave dipole, modified half-wave dipole, yagi, half-wave dipole stripline, air dielectric transmission line feed, full wavelength dipole stripline, parabolic horn, and parabolic trough.

40494 (NASA-TM—84064, pp 223-231) **Rectenna session: micro aspects.** Gutmann, R.J. (Rensselaer Polytchnic Inst., Troy, NY). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

Two micro aspects of rectenna design are discussed: evaluation of the degradation in net rectenna RF to DC conversion efficiency due to power density variations across the rectenna (power combining analysis) and design of Yagi-Uda receiving elements to reduce rectenna cost by decreasing the number of conversion circuits (directional receiving elements). The first of these involves resolving a fundamental question of efficiency potential with a rectenna, while the second involves a design modification with a large potential cost saving.

40495 (NASA-TM—84064, pp 244-250) **Rectenna array measurement results.** Dickinson, R.M. (Jet Propulsion Lab., Pasadena, CA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The measured performance characteristics of a rectenna array are reviewed and compared to the perffformance of a single element. It is shown that the performance may be extrapolated from the individual element to that of the collection of elements. Techniques for current and voltage combining were demonstrated. The array performance as a function of various operating parameters is characterized and techniques for overvoltage protection and automatic fault clearing in the array demonstrated. A method for detecting failed elements also exists. Instrumentation for deriving performance effectiveness is described. Measured harmonic radiation patterns and fundamental frequency scattered patterns for a low level illumination rectenna array are presented.

40496 (NASA-TM—84064, pp 253-257) **Session on solid state: introduction.** (NASA Lyndon B. Johnson Space Center, Houston, TX). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The possibilities of using solid state devices as part of the Satellite Solar Power System are discussed. Solid state advantages and disadvantages are presented along with two potential concepts for use of solid state in the system design.

40497 (NASA-TM—84064, pp 258-267) **Modified reference SPS with solid state transmitting antenna.** Woodcock, G.R.; Sperber, B.R. (Boeing Co., Seattle, WA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

The motivations for considering solid state microwave power amplifiers for the solar power satellite transmitting antenna are the possibilities of greatly increased system reliability due to elimination of electron tube cathodes, a lower mass per unit power and transmitting array area due to the high power densities obtainable in semiconductors, and, probably, cost savings due to development of small hardware items that can be handled by individuals instead of organizations. In order to provide a fair assessment where we stand today with regard to solid state SPS technology, the design described here is close to that of the NASA/DOE reference and is implemented using today's solid state technology with only a small push. The small push is raising the efficiency of DC-RF conversion from the .68 obtained by RCA in 1975 to somewhat over .8 of the solid state SPS. This is generally considered feasible by semiconductor industry representatives. Other solid state SPS configurations can yield somewhat better performance. However, these generally do not provide as fair a vehicle for comparison with the reference and usually also incorporate somewhat more advanced technologies.

40498 (NASA-TM—84064, pp 268-277) **Sps solid state antenna power combiner.** Fitzsimmons, G.W. (Boeing Co., Seattle, WA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

Solid state dc-rf converters offer potential improvements in reliability, mass and low voltage operation, provided that anticipated efficiencies in excess of 80 percent can be realized. Field effect transistors offer the greatest potential in the SPS frequency band at 2.45 GHz. To implement this approach it is essential that means be found to sum the power of many relatively low power solid state sources in a low-loss manner, and that means be provided to properly control the phase of the outputs of the large number of solid state sources required. To avoid the power combining losses associated with circuit hybrids it was proposed that the power from multiple solid state amplifiers be combined by direct coupling of each amplifier's output to the radiating antenna structure. The selected power-combining antenna consists of a unique printed (metalized) microstrip circuit on a ceramic type dielectric substrate which is backed by a shallow lightweight aluminum cavity which sums the power of four microwave sources. The antenna behaves like two one-half wavelength slot-line antennas coupled together via their common cavity structure.

40499 (NASA-TM—84064, pp 279-298) **Solid-state retrodirective phased array concepts for microwave power transmission from solar power satellite.** Schroeder, K.G.; Petroff, I.K. (Rockwell International Corp., Pittsburgh, PA). 1980. NTIS, PC A99/MF A01.

In Workshop on microwave power transmission and reception.

Two prototype solid-state phased array systems concepts for potential use in the Solar Power Satellite are described. In both concepts, the beam is centered on the rectenna by means of phase conjugation of a pilot signal emanating from the ground. Also discussed is on-going solid-state amplifier development.

40500 **(SAND—81-7088/4) Intermediate photovoltaic system application experiment operational performance report. Volume 4, for Beverly High School, Beverly, MA.** (Sandia National Labs., Albuquerque, NM (USA)). Jan 1982. Contract AC04-76DP00789. 47p. NTIS, PC A03/MF A01. Order Number DE82008622.

Performance data are presented for the months of November and December, 1981 for a photovoltaic power supply at a Massachusetts school building. The data include: monthly and daily electrical energy produced; monthly and daily solar energy received; monthly and daily array efficiency; energy produced as a function of power level, voltage, cell temperature, and hour of the day; input, output, and efficiency of two power conditioner units and for the total power conditioning system; energy supplied by the photovoltaic system to the load during each day and month; photovoltaic system efficiency; capacity factor; daily system availability; monthly and hourly insolation; heating and cooling degree days; number of freeze/thaw cycles per month; monthly and hourly ambient temperature; monthly and hourly wind speed; wind direction distribution; hourly cell temperature; and data acquisition mode and recording interval plot. (LEW)

40501 **(SAND—81-7100/6) Intermediate photovoltaic system application experiment operational performance executive summary. Volume 6. Newman Power Station, El Paso, TX.** (Sandia National Labs., Albuquerque, NM (USA)). Jan 1982. Contract AC04-76DP00789. 11p. NTIS, PC A02/MF A01. Order Number DE82008483.

Performance data for the month of December 1981 are given for a 20 kW-peak photovoltaic flat panel power system for an uninterruptable power supply load at an El Paso, Texas utility. Data include monthly total and daily insolation, monthly total and daily electrical energy, and array efficiency. Also plotted are the data acquisition mode and recording intervals for each day of the month. Three site events (maintenance and system problems) are summarized, and missing data from December 25 through December 30 are explained. (LEW)

40502 **Photovoltaic system studies and developments.** Schueler, D.G. (Sandia Laboratories, Albuquerque, NM). pp 1832-1834 of Proceedings of 16th intersociety energy conversion engineering conference, Atlanta, GA, August 9-14, 1981. Volume 2. New York, NY; American Society of Mechanical Engineers (1981).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

Photovoltaic technology has the potential of reducing dependence on conventional energy sources, if the cost of photovoltaic systems can be brought down in the range of $2 per peak Watt. The major potential applications for photovoltaic technology have been extensively analyzed with regard to their economics, market potential, and system performance requirements. These include residential, commercial and industrial, and utility central generation applications. This paper reviews the essential features of these various applications and outlines ongoing development activities.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 40618

40503 (BMFT-FB-T—79-139) A 10 kW small solar power station and operations optimization. Final report. Gloel, J. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Wedel (Germany, F.R.)). Dec 1980. 123p. NTIS, PC A06/MF A01.

Characteristics of the plant are: unpressurized hot water (95°C) for transport and storage of thermal energy screw expansion engine operating with freon R114 for thermo-mechanical energy conversion and an ac three phase generator interconnected with a static converter to provide line voltages and frequencies. A solar collector simulator was used in testing. Selection, assembly, and function of the system and each subsystem are detailed. Component performance results are listed. Component by component operation optimization results show the importance of correctly regulating the thermal cycle temperature as well as the freon expansion pump circuit pressure.

40504 (MCR—75-366(4/76)) 1-MWth bench model solar cavity receiver steam generator build and test. (Martin Marietta Aerospace, Denver, CO (USA)). Apr 1976. Contract AC03-76ET20183. 27p. NTIS, PC A03/MF A01. Order Number DE82004204.

The fabrication phase of the program was completed on schedule and within budget. The Phase I (cold flow) testing was completed. A Phase 1 test report was submitted. This test phase met all objectives. All anomalies were resolved prior to the start of Phase 2 testing. The system was shipped to Sandia on March 9, 1976. Phase 2 test preparations are now complete and testing will start on April 5, 1976. These preparations included an installation of and checkout of the entire receiver test system, the Sandia radiant heater assembly, and the Georgia Tech water monitoring and treatment equipment. The program is on schedule and within budget constraints.

40505 (NASA-CR—159588) Design study of a kinematic Stirling engine for dispered solar electric power systems. Final report, 1979 - 1980. (United Stirling A.B. Malmo (Sweden)). 1980. 124p. NTIS PC A06/MF A01.

The concept evaluation shows that the four cylinder double acting U type Stirling engine with annular regenerators is the most suitable engine type for the 15 kW solar application with respect to design, performance and cost. Results show that near term performance for a metallic Stirling engine is 42% efficiency. Further improved components show an impact on efficiency of the future metallic engine to 45%. Increase of heater temperature, through the introduction of ceramic components, contribute the greatest amount to achieve high efficiency goals. Future ceramic Stirling engines for solar applications show an efficiency of around 50%.

40506 (NASA-CR—164530) 1-kW solar Stirling experiment. Final report. Giandomenico, A. (Jet Propulsion Lab., Pasadena, CA (USA)). May 1981. 107p. NTIS PC A06/MF A01.

The objective of this experiment was to demonstrate electrical power generation using a small free-piston Stirling engine and linear alternator in conjunction with a parabolic solar collector. A test bed collector, formerly used at the JPL Table Mountain Observatory, was renovated and used to obtain practical experience and to determine test receiver performance. The collector was mounted on a two-axis tracker, with a cold water calorimeter mounted on the collector to measure its efficiency, while a separate, independently tracking radiometer was used to measure solar insolation. The solar receiver was designed to absorb energy from the collector, then transfer the resulting thermal energy to the Stirling engine. Successful testing of receiver/collector assembly yielded valuable inputs for design of the Stirling engine heater head.

1408 Ocean Thermal Gradient And Salinity Gradient

Power Systems

40507 (UNIHI-SEAGRANT-AB—82-01) Solar energy from the sea. Tabata, R.S. (Hawaii Univ., Honolulu (USA). Sea Grant Coll. Program). Oct 1981. 4p. University of Hawaii, Sea Grant College Program, 1000 Pope Rd., Room 200, Honolulu, HI 96822.

Questions addressed include: what is OTEC, what could OTEC mean for the future, what are some advantages and disadvantages of OTEC, who's working on OTEC, what's happening with OTEC in Hawaii, and what are some possible environmental concerns now being studied. A list of publications, films, and information sources is included. The OTEC resource of the Pacific Ocean is mapped and the closed-cycle OTEC process is explained in elementary terms. (LEW)

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 40632, 40924, 40931, 40932, 40933, 40937, 40937, 40959, 40960, 40963, 40966, 40966, 40967, 40970

40508 (AD-A—102714/3) Study of passive solar space heating techniques applied to family housing units within the continental United States. Master's thesis. Carr, W.F. Jr. (Naval Postgraduate School, Monterey, CA (USA)). Mar 1981. 135p. (NPS—54-81-003). NTIS, PC A07/MF A01.

Passive solar energy is presented as an alternative to conventional space heating for existing and future government family housing units. The extent of the current energy problem is presented together with the implications of the findings of the Workshop on Alternative Energy Strategies. These findings significantly influence the impending energy problems facing the Department of Defense. A technical analysis is made of five passive solar space-heating design alternatives in five climate zones within the continental United States to determine the potential savings in conventional heating fuel and dollars to the Department of Defense. In addition, major advantages and disadvantages of solar energy are presented. Recommendations for the utilization of passive solar energy in family housing units conclude the thesis.

40509 (BMFT-FB-T—80-079) A solar energy system as a complement to a conventional heating system: measurement of the storage and consumption of solar energy. Final report. Doering, E.; Lippe, W. (Fachhochschule, Esslingen (West Germany)). Sep 1980. 51p. NTIS, PC A04/MF A01.

A residential house, having a fuel oil based heating system (radiators and floor heating domestic hot water), was equipped with a solar energy conversion plant which supplemented the water heating system. Total insolation, the energy received by the solar collectors, and energy consumption for heating and domestic hot water were monitored. Results show the collector system to have a conversion efficiency of 15.4%. The solar energy system contribution to overall energy consumption was 6.1%. Improvement of the solar energy plant is discussed. Suggestions include enlarging the collector surface, atteration of the regulation scheme, utilization of thermal stratification in the conception of solar heat storage, better insulation of conduit pipes, and avoidance of shadowing the collectors. (ESA)

40510 (BMFT-FB-T—80-113) Development of an economic solar heating system with cost efficient flat plate collectors. Final report. Eder-Milchgeisser, W.; Burkart, R. (Man-Turbomotoren G.m.b.H., Munich (West Germany)). Oct 1980. 24p. NTIS, PC A02/MF A01.

Mass produced flat plate solar collectors were worked into the design of a system for heating a swimming pool and/or providing domestic hot water. The collector characteristics, including physical and mechanical data as well as theoretical energy conversion efficiency, are presented. The collector was tested and service life efficiency was determined. The mounting of the collector, depending on roof type, is explained. Both in service and laboratory test results demonstrate the cost effectiveness of the system. Further improvement of efficiency is envisaged with automatic flow control in the solar collector and hot water circuits. (ESA)

40511 (CONF-810832—, pp 1.1-1.2) **Overview of the passive and hybrid solar energy program.** Morse, F.H. Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40512 (CONF-810832—, pp 1.3-1.5) **National passive and hybrid solar energy program.** Maybaum, M.W. (Dept. of Energy, Washington, DC). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Progress is described on the following: objectives, multi-year plan, residential buildings, commercial buildings, materials and components, and solar cities and towns. (MHR)

40513 (CONF-810832—, pp 1.6-1.8) **Passive program.** Johnson, K. (Mid American Solar Energy Complex, Minneapolis, MN). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

MASEC's Passive Program has expanded on the initial success of the Solar 80 Program to increase the number of passive solar designs available for single family residences to 20, and to use the design/build concept for development of passive solar retrofit designs and passive solar designs for multi-family housing. MASEC has made over 150 presentations on passive solar and the Solar 80 program to over 13,000 people and has conducted training workshops for architects, builders, realtors, bankers, educators and members of other professional groups. The development of training manuals, workbooks, audio/visual presentations and a Passive Products Catalogue is an integral part of this effort to educate various multiplier groups which are important in generating acceptance and use of passive technologies.

40514 (CONF-810832—, pp 1.9-1.11) **Northeast Solar Energy Center's FY '81 passive program.** Thomas, D.O. (Northeast Solar Energy Center, Boston, MA). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The passive program is reviewed as follows: system design, design development, industry support and technology transfer, education, public information, and solar cities. (MHR)

40515 (CONF-810832—, pp 1.12-1.14) **Southern Solar Energy Center passive building program.** Borden, J.O.; Porter, C.B. (Southern Solar Energy Center, Atlanta, GA). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Among the significant achievements of the SSEC passive building programs are the design and construction of affordable passive solar homes. These homes average from 1100 to 1600 sq. ft. in size and are marketed at prices ranging from $45,000 to $85,000. In these projects, SSEC has been a consultant for design and thermal analysis and has conducted field tests for design tool verification. Other program activities involve the design and development of a sunspace and breadbox water heater for retrofit applications. Efforts are also continuing with urban development and commercial applications with emphasis on cooling locations. SSEC has developed and implemented several design tool programs involving both main frame and mini-computers. In addition to SSEC's involvement with the class B and C performance monitoring program, special monitoring programs and studies have been developed. SSEC has established good working relationships with numerous trade associations, including NAHB, NAHM, NCMA, BIA, PSIC, and others. Cooperative efforts with these associations have resulted in successful workshops and solar technology transfer to their memberships.

40516 (CONF-810832—, pp 1.15-1.16) **1981 passive and hybrid solar energy program.** Klapper, S. (Western Solar Utilization Network, Portland, OR). Feb 1982. NTIS, PC A17/MF A01. AC02-79CS30159.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The objectives, projective description, and evaluative data are presented for the following projects: passive design competition; major builders project; home builders workshops; Portland solar home builders program; Class B monitoring Plan catalog; technical assistance to builders; passive products directory; and union assistance. (MHR)

40517 (CONF-810832—, pp 2.1-2.2) **Residential passive design/build project with emphasis on cooling in the Orlando, Florida area.** Asendorf, J. (AGPT & Associates, Inc., Orlando, FL). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The design phase of this project is completed and construction is beginning. The design phase accomplished the following. An analysis was performed of the housing market and climate in the Orlando, Florida area to assure market acceptance and thermal performance of the final design. Three designs were developed and presented to the design committee, of which two were accepted for further development. It was determined that a significant thermal mass was desireable on the interior of the houses. A construction technique was developed that uses conventional materials and methods of building to maintain a high thermal mass within a well insulated building envelope. The houses are designed to dampen the peak heat gain during the day of the cooling season, releasing it at night when it can be vented to the cooler night air. In addition, they should provide about 30% of their heating demand from a passive solar heating design consisting of south facing glazing with night insulation, which allows sunlight to heat up a portion of the building's thermal mass during sunny periods.

40518 (CONF-810832—, pp 2.3-2.4) **SERI Metro Denver home builder program: an evaluation from a design consultant's standpoint.** Leach, J.W. (Downing/Leach & Associates, Boulder, CO). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A program involving builders in designing and building homes to be included in a passive solar Parade of Homes is described. Public response, marketing, attitudes, and follow-up activities are described. (MHR)

40519 (CONF-810832—, pp 2.6) **Residential passive design/build project with emphasis on heating in Norfolk, Virginia.** Fitts, R.J. (Gideon Enterprises, Inc., Virginia Beach, VA). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Two homes have been designed which meet the project objectives. Model 1 is an 1100 sq. ft., 3 bedroom, 1-1/2 bath home expected to sell for $59,000.00 (on a $12,000.00 lot) and Model 2 is a 1528 sq. ft., 4 bedroom, 2-1/2 bath home expected to sell for $63,000.00. Low mass, direct gain with moderate insulation was found to be the most cost-effective passive solar/energy conservation strategy. The average annual energy consumption of both homes is 15,750 Btu/SF-y and the Solar Savings Fractions are .31 and .24, respectively.

40520 (CONF-810832—, pp 2.7-2.9) **Research data collection and analysis for national passive/hybrid solar program.** Klein, N. (Market Facts, Inc., Arlington, VA). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40521 (CONF-810832—, pp 2.10-2.12) **Passive & hybrid solar energy residential state-of-the-art.** Johnson, R.J. (NAHB Research Foundation, Inc., Rockville, MD). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40522 (CONF-810832—, pp 2A.16-2A.18) **Unified interzone and system coupling methodology/passive commercial buildings for BEPS.** Cumali, Z. (CCB/CUMALI Associates, Oakland, CA). Feb 1982. NTIS, PC A17/MF A01. Contract AC03-80SF10840.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The development of a version of DOE-2 which permits a choice of load calculation methods within a common intermediate algorithmic framework has significantly added to the program's capabilities. A design was selected and documented for each of five climate types: hot and dry, warm and humid, cold, severe temperate and mild temperate. A small office building - approximately 30,000 square feet - was selected as the single building type for all climates. Certain characteristics common to all the designs included items related to internal heat gain establishment of comfort criteria and operation of the HVAC system/plant configuration. The passive feature and building configurations specified for each climate type are summarized.

40523 (CONF-810832—, pp 2A.19-2A.20) **Overview of passive and hybrid design and analysis tools.** Sullivan, P.W. (Enersource, Inc., Peterborough, NH). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Passive design and analysis tools have developed rapidly since the first passive conference six years ago. However, only passive heating of residential buildings has a full complement of design tools while other passive considerations and other building types have been inadequately developed. A significant trend in design tool development has been the recent emergence of private sector firms to develop and disseminate tools based on prior rigorous research work. Also, recent efforts have taken place to coordinate a broad range of private and public sector activities in design tool research, development and dissemination.

40524 (CONF-810832—, pp 2A.21-2A.25) **Design implications of total energy analysis.** Kammerud, R.C.; Place, J.W. (Lawrence Berkeley Lab., CA). Feb 1982. NTIS, PC A17/MF A01. Contract W-7405-ENG-48.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Development of the building energy analysis computer program BLAST-3.0 was completed and the program was released into the public domain. Applications of BLAST-3.0 to both residential and commercial buildings have been carried out. (MHR)

40525 (CONF-810832—, pp 2A.26-2A.28) **Passive solar analysis and design of commercial buildings using DOE-2.** Hunn, B.D. (Los Alamos National Lab., NM). Feb 1982. NTIS, PC A17/MF A01. Contract W-7405-ENG-36.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The custom weighting-factor loads calculative method that was implemented in the DOE-2.1 program was refined and documented. This method allows direct-gain and night-ventilative-cooling passive systems to be analyzed using DOE-2. A thermal storage wall model for DOE-2 was designed and tested. This model treats vented and unvented storage walls using either masonry or water as the storage medium. It includes the effect of night insulation and selective surfaces. A model for attached sun- spaces, atriums, and buffer spaces has also been developed for DOE-2. This model simulates interzone convection (forced or natural), and interzone conduction through massive walls. A case study of Warner Hall at Carnegie-Mellon University in Pittsburgh, Pennsylvania was completed as part of the DOE Passive Solar Commercial Buildings Program. DOE-2 was used in an analysis of several passive solar and energy conservation retrofit options. The Los Alamos analysis served as a basis for comparison to a more limited (in time and budget) analysis done by the energy consultant for the retrofit project. We also participated in a predesign analysis study, coordinated by the Solar Energy Research Institute, in which DOE-2 results were compared with results of four other analysis/design tools, ranging from manual to high-level computer methods. The results will be documented in the design handbook that is being prepared under the DOE Passive Solar Commercial Buildings Program.

40526 (CONF-810832—, pp 2A.29-2A.31) **Passive solar design handbook.** Jones, R.W. (Los Alamos National Lab., NM). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The Passive Solar Design Handbook, Volume Three, will update Volume Two by presenting extensive new data on the optimum mix of conservation and solar, direct gain, sunspaces, thermal storage walls, and solar radiation. The direct gain, therml storage wall, and solar radiation. The direct gain, thermal storage wall and solar radiation data are greatly expanded relative to the Volume Two coverage.

40527 (CONF-810832—, pp 2A.32-2A.33) **Passive solar construction handbook.** Heibein, S. (National Concrete Masonry Association, Herndon, VA). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A state of the art guide for homebuilders on constructing passive solar homes was written. Figures have been excerpted from the publication in an effort to show the quality, organization, and type of information provided in the handbook. The scope of the book was limited to construction materials already used by builders and care was taken to avoid reference to specific passive solar products since it was felt that builders would be more receptive if they were presented with familiar materials used in a more energy efficient way.

40528 (CONF-810832—, pp 2A.34-2A.36) **Passive building climatology curriculum development.** Prowler, D.; Fraker, H. (Univ. of Pennsylvania, Philadelphia). Feb 1982. NTIS, PC A17/MF A01. Contract AC02-79CS30241.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The development of subject-oriented resource packages in passive building climatology aimed at the pedagogical needs of architecture education is discussed. (MHR)

40529 (CONF-810832—, pp 2A.37) **BEPS technical support.** Hughes, P. (Science Applications, Inc., Mclean, VA). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40530 (CONF-810832—, pp 2A.38-2A.40) **Design and analysis tool validation.** Judkoff, R. (Solar Energy Research Inst., Golden, CO). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Each Building Energy Analysis Simulation analyzes the same buildings using the same sets of weather data. Phase I and II of the Comparative Studies have been completed using DOE-2.1, BLAST-2MRT, BLAST-3.0, SUNCAT-2.4, DEROB-3, and DEROB-4. The derivation of analytical solutions has been completed, and all of the above computer programs have been run through the analytical verification procedure. Five two-zone test cells have been constructed and instrumented. The data acquisition and reduction system for these cells is about 99% complete. A co-heating procedure has been developed for deriving heat-loss coefficients suitable for input to the computer programs. Data requirement specifications for validation have been issued to the Class A Monitoring Program. The low-cal house and an NBS test building are being encoded for SUNCAT-2.4, DOE-2.1, and DEROB-4 in order to test the Class A Monitoring data specifications and the empirical validation procedure.

40531 (CONF-810832—, pp 2A.41-2A.43) **Simulation and design of passive processes.** Duffie, J.A.; Beckman, W.A.; Klein, S.A.; Mitchell, J.W. (Univ. of Wisconsin, Madison). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The University of Wisconsin passive solar program is divided into four separate, but related areas: (1) a general design method

for direct-gain passive buildings (referred to as the Un-utilizability method was developed during the last contract period. An analogus method for collector-storage wall buildings has been devised; (2) both the direct gain and collector-storage wall design methods require an estimate of the effective building capacitance; a method of estimating the effective capacitance in terms of the construction parameters of the building is under development; (3) simulation models for direct-gain and collector-storage walls now reside in the TRNSYS program. The capacity to simulate sunspaces is being incorporated; (4) all passive design methods require estimates of the building loads. Improvements in the existing degree-day base shifting algorithms are being investigated.

40532 (CONF-810832—, pp 2B.44-2B.45) **Construction, instrumentation and testing of the REPEAT facility.** Winn, C.B. (Colorado State Univ., Fort Collins, CO). Feb 1982. NTIS, PC A17/MF A01. AC02-80CS30259.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A functional diagram of the REPEAT facility is shown in which the principal design features are illustrated. Project accomplishments are listed. (MHR)

40533 (CONF-810832—, pp 2B.46-2B.47) **Analytical and experimental investigation of the Trombe wall.** Casperson, R.L. (Energy Engineering Group, Inc., Golden, CO). Feb 1982. NTIS, PC A17/MF A01. Contract FG02-79CS30244.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

This project was initiated to provide detailed thermocirculation data for the vented Trombe wall. The current experimental work includes the use of much improved anemometry with velocity and temperature profiles measured simultaneously at two elevations on the wall. In addition, the hot-film anemometry employs special low-speed calibrations and signal averaging equipment.

40534 (CONF-810832—, pp 2B.48-2B.50) **Class B passive cooling monitoring program.** Fowlkes, C.W. (Fowlkes Engineering, Bozeman, MT). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A passively cooled test building has been instrumented to test the Class B data acquisition hardware, software, and the cooling performance factors. The test building is a Skytherm-type design currently instrumented to the Class A level. Comparison of Class A and Class B will be one of the outputs of this work. Passive cooling performance parameters have been generated which are compatible with the Class B instrumentation and methodology. Low-cost transducers to measure infrared radiation auxiliary latent heat removal and relative humidity have been interfaced to the data acquisition system and tested for two months or more.

40535 (CONF-810832—, pp 2B.51-2B.53) **Results of Class C thermal performance evaluation: technical data.** Hamilton, B.; Sachs, B. (Memphremagog Group, Newport, VT). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

337 audits of passive solar homes were conducted between June, 1980 and February, 1981. 100 sites were audited in the NESEC region, 80 in the MASEC region, 93 in the SSEC region and 64 in the WSUN region. 335 of these have usable non-technical data provided by the occupant(s). Only about 80% of these had complete enough and usable technical and energy consumption data for complete technical analysis. Only about 50% were suitable for the design-tool comparison study. Non-technical data has been tabulated and analyzed regionally. A study comparing the actual energy use of audited homes with the predictions of a common design tool (FCHART/SLR) is being done. The results presented are examples of the types of information contained in the Class C technical data. Initial results are based only on sites in the NESEC and WSUN regions.

40536 (CONF-810832—, pp 2B.54) **Analysis of performance of passive solar heated Patoka Nature Center.** Moore, F. (Miami Univ., Oxford, OH). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The thermal heating performance of the passive solar heated Patoka Nature Center was monitored by determining the annual solar heating contribution using Class B monitoring techniques.

40537 (CONF-810832—, pp 2B.55-2B.57) **Short term testing to determine the thermal characteristics of as-built passive solar houses.** Kedzierski, R. (NAHB Research Foundation, Inc., Rockville, MD); Lau, A. Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The development of a short-term test procedure aimed at quantifying those building parameters which are most susceptible to variance in the field is emphasized. The test results will be used to predict long term building energy consumption. Testing is designed for unoccupiedd houses and a period of two to three days, however, variability in weather and other uncontrollable factors may result in longer time periods being required.

40538 (CONF-810832—, pp 2B.58-2B.61) **New Mexico State University Passive Skytherm/sup TM/ House.** Mancini, T.R. (New Mexico State Univ., Las Cruces). Feb 1982. NTIS, PC A17/MF A01. Contract AC03-80CS30228.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The New Mexico State University Passive Skytherm/sup TM/ House, some of the results from the 1979 cooling season, the present testing program, and the tests to be performed during the 1982 cooling season are described. The primary objectives of the project are to obtain data on the effect that water depth, insulating air cells, and massive walls have on the Skytherm/sup TM/ system.

40539 (CONF-810832—, pp 2B.62-2B.64) **Preliminary Class B results.** Holtz, M.; Frey, D.J. (Solar Energy Research Inst., Golden, CO). Feb 1982. NTIS, PC A17/MF/A01. Contract EG-77-C-01-4042.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A program for low-cost thermal performance monitoring of passive solar residential buildings around the country using a microprocessor based data acquisition system with on-site data reduction and hourly storage of data on cassette tape is described.

40540 (CONF-810832—, pp 2B.65-2B.66) **Class C performance evaluation program.** Towle, S.; Thomas, T. (Solar Energy Research Inst., Golden, CO). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The Class C study focuses on the field collection and analysis of noninstrumented performance data from a large sample of occupied passive and hybrid solar houses. (MHR)

40541 (CONF-810832—, pp 2B.67-2B.70) **Overview of TVA's residential passive solar monitoring.** Robertson, F.R. (Tennessee Valley Authority, Chattanooga). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

TVA's residential passive solar projects include the following: Solar Homes for the Valley, Solar Modular Homes, Solar House Design Portfolio, and passive solar test cells. TVA's instrumentation level classifications for site data acquisition systems are presented: design verification, performance verification, load-profile, sight-read, and survey. (MHR)

40542 (CONF-810832—, pp 2B.71-2B.73) **Solar atrium: a hybrid system of solar heating and cooling.** Ueland, M. (Ueland and Junker, Philadelphia, PA). Feb 1982. NTIS, PC A17/MF A01. Contract FG02-77CS34135.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The solar atrium demonstration residence was made fully operational in January, 1981. Thermal performance data was collected on three different occasions, in August, 1980; in December, 1980, and in February, 1981. An evaluation of its performance with respect to project objectives is presented. A view of the residence is shown.

40543 (CONF-810832—, pp 2B.74-2B.76) **NSDN passive program.** Pollock, E.O. (Automation Industries, Inc., Silver Spring, MD). Feb 1982. NTIS, PC A17/MF A01. Contract AC01-79CS30027.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Performance of 12 passive space heating systems was evaluated during the past heating season. The systems include nine direct gain systems, four which use only the floor slab and walls for storage and five which augment storage with water filled containers. Two of the sites have greenhouses with a mass wall between the greenhouse and conditioned living space. The final site is a double envelope design. Data for these systems is currently being compiled and analyzed. Distinguishing features for the 12 systems are discussed.

40544 (CONF-810832—, pp 2C.77-2C.79) **Construction and monitoring of the Independence III house.** Milliken, A.N. (Acorn Structures, Inc., Concord, MA). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30363.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A traditional salt box design was chosen for the house using direct gain and sunspace features. Cooling is provided by natural cross-ventilation and chimney effect, supplemented by an attic exhaust fan, and by four parallel underground cool tubes. The insulation and buyer appeal are discussed. (MHR)

40545 (CONF-810832—, pp 2C.80-2C.82) **Design of passive/hybrid solar systems for manufactured metal buildings for commercial and industrial applications.** Watkins, N. (Gulf States Manufacturers, Inc., Starkville, MS); Bouchillon, C.W. Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30374.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Three optional system preliminary designs based on concepts presented above were generated based on the generic types of Direct Gain, the Trombe Wall-vented and unvented, and the Convective Wall. A computer program for building thermal and lighting energy analysis based on a modified BIN-DATA method was modified to provide for Direct Gain and South Vertical Wall Solar Collectors with no storage, storage to carry the building through 8 PM after a clear day and for sufficient storage capacity for a 24 hour period. Life Cycle cost analyses were performed on these systems. The preliminary designs were reviewed and the selection of the Convective Wall Panel Solar Collector with Integrated Floor Slab Storage complemented with triple glazed Daylighting Panels on appropriate projects were made.

40546 (CONF-810832—, pp 2C.83-2C.84) **Prefabricating solar components passive solar manufactured building program.** Carusone, J. (Northern Homes, Inc., Hudson Falls, NY). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30378.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Experience with manufacturing Trombe walls and sun spaces is reviewed. Plans for a passive solar heated colonial home and passive solar heated contemporary are described. The use of super insulation and the marketing results are reviewed. (MHR)

40547 (CONF-810832—, pp 2C.85-2C.87) **Passive and hybrid solar manufactured housing and buildings.** Maloney, T.J.; Arsenault, P.J. Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30369.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The design and analysis of a solar home series to be manufactured and marketed by Consolidated Properties has been completed. The design includes a variable alternative wall framing system, a proven solar system, and state-of-the-art energy conserving features. The final house design is judged very marketable and cost effective.

40548 (CONF-810832—, pp 2C.88-2C.91) **Passive and hybrid solar heating for manufactured housing.** Usry, J.D. (Usry Inc., Richmond, VA). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30385.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The problems involved in incorporating passive design features into the framework of manufactured housing expertise are explored. Designs for direct gain and solarium models were prepared. (MHR)

40549 (CONF-810832—, pp 3.4-3.5) **Transwall research.** Mcclelland, J.F. (Ames Lab., IA). Feb 1982. NTIS, PC A17/MF A01. Contract W-7405-ENG-82.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Accomplishments in the last year include: (1) design, fabrication, and installation of a Transwall prototype with aluminum framed all glass modules; (2) construction of a test facility for the system that allows studies under realistic building conditions; (3) investigation of thermal performance, materials problems, and operating history in the test facility and laboratory, and by modeling calculations.

40550 (CONF-810832—, pp 3.16-3.17) **Radiative cooling materials.** Brookes, J. (Energy Materials Research Co., Berkeley, CA). Feb 1982. NTIS, PC A17/MF A01. Contract FC03-80SF11504.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Material selection for selective emitter and glazings is complete. Optical testing has been completed, exposure testing is ongoing. Small scale production runs of glazing materials have been made.

40551 (CONF-810832—, pp 3.24-3.34) **Los Alamos National Laboratory Passive Solar Program.** Neeper, D.A. (Los Alamos National Lab., NM). Feb 1982. NTIS, PC A17/MF A01. Contract W-7405-ENG-36.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Progress in passive solar tasks performed at the Los Alamos National Laboratory for FY-81 is documented. A third volume of the Passive Solar Design Handbook is nearly complete. Twenty-eight configurations of sunspaces were studied using our solar load ratio method of predicting performance; the configuration showing best performance is discussed. We have noted and measured the minimum level of insolation needed to generate convective flow in our thermosiphon test rig. Information on test room performance, off-peak auxiliary electric heating for a passive home, free convection experiment, monitored buildings, and technical support to the US Department of Energy is included.

40552 (CONF-810832—, pp 3.35-3.37) **High performance glazing products.** Johnson, T.E. (Massachusetts Inst. of Tech., Cambridge). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Two new varieties of high R, high transmission windows have just reached the market, a selective transmitter on glass, and an antireflective coating for films. The products performance and relative merits are discussed.

40553 (CONF-810832—, pp 3.41-3.43) **Test methods and procedures for passive solar components and materials.** Feb 1982. NTIS, PC A17/MF A01. Contract AI01-76PR06010.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Progress on a standards plan, health and safety issues, and thermal test methods is reviewed. (MHR)

40554 (CONF-810832—, pp 3.44-3.46) **Passive cooling and heating program at Oak Ridge National Laboratory For FY-1981.** Shapira, H.B.; Kaplan, S.I.; Chester, C.V. (Oak Ridge National Lab., TN). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

When ORNL's Holifield Heavy Ion Research Facility needed a new office/living-quarters complex, the Solar Applications Group in the Energy Division seized the opportunity to implement some energy-saving design concepts. The building, Joint Institute for Heavy Ion Research (JIHIR), was designed to maximize energy savings. Extensive analyses and simulations were performed in order to design energy-saving features, and these were refined, along with architectural changes. The design of the building provided us with the opportunity to incorporate an energy performance instrumentation net that will be described in this report. Familiarity with the relationship between architectural considerations, human comfort, and energy consumption characteristics (through the design process of JIHIR) led to the conception and development of the Reflective Insulating Blinds (RIB). The need for vegetative cooling methods for the humid, hot Southeast was recognized, and, in addition, an experiment with rockbed cooling was conceived.

40555 (CONF-810832—, pp 3.47-3.49) **Marketable products for passive solar applications Omnibus Thermal Storage Module.** Maloney, T.J.; Arsenault, P.J. (One Design, Inc., Winchester, VA). Feb 1982. NTIS, PC A17/MF A01. Contract AC02-80CS30526.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

To date the Omnibus Thermal Storage Module (OTSM) has been reduced to two manufacturable parts which can be assembled in different fashions to satisfy all eleven market applications. Enroute to final design and development of these two parts, response from industry has been overwhelmingly strong. Manufactured building companies, architects, furniture designers, solar collector companies, plastics companies, manufacturers of chemical phase change materials and many others have all participated in the design process of the OTSM. Further, a need was expressed for such a product in their market and a willingness to support the use of such a product in their respective industries. In addition, a third product has grown as a direct result of this contract into a fully self-insulated thermal storage system. This third product may develop into a variation of the OTSM or, if study so indicates, a separate passive solar product.

40556 (CONF-810832—, pp 3.50-3.51) **Marketable products for passive solar applications one design waterwall/sup TM/ engineering field test.** Maloney, T.J.; Arsenault, P.J. (One Design, Inc., Winchester, VA). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The purpose of this project is to complete engineering field testing of three waterwall modules preparatory to final commercialization. To date, thirteen field applications are in place or being prepared for installation around the country. These applications include locations in the Northeast, South, Midwest and Alaska. One of these applications is a completely monitored mobile test cell structure which provides the most complete and accurate thermal data. This One Design operated facility allows side by side evaluation of different waterwalls and/or solar systems with computerized monitoring of performance. Because it is a mobile facility it can be moved to any climate for actual testing and comparison between locations and climates.

40557 (CONF-810832—, pp 3.53-3.54) **SUNBIN passive waterwall.** Bourne, R.C. (Solar Concept Development Co., Davis, CA). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30529.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Detailed designs were developed for two versions of the SUNBIN passive water wall system and prototypes were constructed. Thermal performance monitoring has begun. A modular structural system has been developed allowing standardization of the components and easy integration into conventional woodframe construction.

40558 (CONF-810832—, pp 3.55-3.58) **Innovative building systems.** Ortega, J.K.E. (Solar Energy Research Inst., Golden, CO). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Accomplishments on the following are reviewed: composite storage walls, window systems with high insulation characteristics, radiation and free convection shields with thermal storage walls, and double-envelope building investigations. (MHR)

40559 (CONF-810832—, pp 3.59-3.61) **Heat mirror/sub TM/ transparent insulation and the trend toward high performance glazing.** Hodge, M.H. (Southwall Corp., Palo Alto, CA). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Heat Mirror/sub TM/ Transparent Insulation offers superior performance (emissivity, transmission, color neutrality) at lower cost than other approaches to high performance glazing. The joint Southwall - DOE Superglass/sub TM/ project has initially demonstrated a suitable mounting and insulating unit manufacturing technology. The related Heat Mirror II/sub TM/ project offers future promise that the benefits of Heat Mirror/sub TM/ may be extended beyond sealed insulating glass applications to vented applications.

40560 (CONF-810832—, pp 3.62-3.63) **Trombe wall unidirectional damper.** Katz, H.S. (Sunearth Solar Products Corp., Harleysville, PA). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30581.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The proof of concept preprototype testing demonstrated that a standard design draft control device would operate in an actual Trombe wall. An insulated flap designed as the final prototype to Phase I was both technically feasible and within the cost constraints of our marketing survey.

40561 (CONF-810832—, pp 3.64-3.66) **Exterior insulating shutter design and marketing studies.** Dike, G.; Kinney, L. (Syracuse Research Corp., NY). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30584.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Three designs of exterior insulating shutters are described. Each system was tested to determine the operational characteristics of the shutters and the results are discussed. (MHR)

40562 (CONF-810832—, pp 3.70-3.71) **Evaluation of the FCHART/SLR solar design process.** Temple, P.L. (Total Environmental Action, Inc., Harrisville, NH). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A statistically over significant over-prediction of auxiliary energy use by the FCHART/SLR design tool was identified. In addition to this overpredicted bias (mean percent error = 64%), there was a large random error. Other technical accomplishments include the identification of (1) a significant bias toward under-prediction of Solar Savings Fraction, and (2) a significantly more accurate prediction of auxiliary by FCHART/SLR, than by the same tool with the solar component deactivated. The predicted and the

estimated actual auxiliary values for the 41 sites in the Northeast were presented.

40563 (CONF-810832—, pp 3.72-3.74) **Development of a high efficiency vapor compression dehumidifier.** Doderer, E. (Trinity Univ., San Antonio, TX). Feb 1982. NTIS, PC A17/MF A01. Contract FC03-80SF11505.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40564 (CONF-810832—, pp 3.75-3.78) **Overview of the National Passive Solar Materials and Components Subprogram.** Burke, R. (Dept. of Energy, Washington, DC). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40565 (CONF-810832—, pp 4.1-4.3) **Passive solar Alaskan school Phase II & III.** Leonard, L.E. (Dept. of Transportation and Public Facilities, Fairbanks, AK). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30321.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The design development of a passive solar building unit with a solar savings fraction of approximately 45% for space heating is described. Solar include south glazing for direct gain, exterior night insulation, and an automatically adjusting daylighting system. (MHR)

40566 (CONF-810832—, pp 4.4-4.7) **St. Mary's School multi-use addition.** Reeder, B.C. (ARCHETYPE for Architect's Group Practice, Washington, DC). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30362.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A gymnasium/auditorium facility designed for an elementary school is described. The design incorporates a Trombe wall, roof apertures for daylighting, and a lighting analysis. (MHR)

40567 (CONF-810832—, pp 4.12-4.14) **Abrams primary school passive solar energy project.** Peacher, D.L. (Bessemer Board of Education, AL). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30324.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

This school building incorporates improved lighting, thermal mass, and roof monitor system to collect solar heat and daylight passively. The design development process is described. (MHR)

40568 (CONF-810832—, pp 4.15-4.18) **Economic analysis of selected passive solar commercial buildings.** Hart, K. (Booz, Allen & Hamilton, Bethesda, MD); Gordon, H.T.; Whiddon, W.I.; McIsaac, I.S. Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40569 (CONF-810832—, pp 4.19-4.21) **Passive-hybrid heating and daylighting concepts for commercial/industrial pre-engineered buildings.** Snyder, M.K. (Butler Manufacturing Co., Grandview, MO). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30367.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40570 (CONF-810832—, pp 4.22-4.24) **Deadwood, Oregon community center & fire hall.** Brown, G.Z.; Reynolds, J.S. (Equinox Design, Inc., Eugene, OR). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30336.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40571 (CONF-810832—, pp 4.25-4.26) **Passive solar commercial buildings design assistance and demonstration.** Johnson, D.M. (Gunnison County, CO). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30339.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A new airport terminal building in a recreational oriented market which optimized a low mechanized hybrid passive solar system was designed and built. Located at 7664 feet in the Central Rocky Mountains in Colorado, the primary concern was to design for the extreme heating loads while the cooling cycle was not of any significance. The Building is rectangular with the long dimension facing south. The construction is heavy timber and framed with solid masonry, thermal storage wall infills. The building is basically one story with a mezzanine level in the raised central portion. The size totals 9700 square feet.

40572 (CONF-810832—, pp 4.27-4.29) **Mount Airy Public Library, Mount Airy, North Carolina.** Morgan, J.G. Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30329.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40573 (CONF-810832—, pp 4.30-4.32) **Southwest Woodbridge Passive Solar Elementary School.** McCaughey, O.J. (McCaughey & Smith Energy Associates, Inc., Tustin, CA). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS53041.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40574 (CONF-810832—, pp 4.33-4.35) **Passive commercial retrofit.** Kieffer, B.D. (North Design Architecture/Engineering/Planning, Madison, WI). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30343.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40575 (CONF-810832—, pp 4.36-4.38) **Doubling and tripling passive design returns: combining heating, cooling and daylighting.** Fraker, H. (Princeton Energy Group, Princeton, NJ). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30348.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40576 (CONF-810832—, pp 4.39-4.41) **RPI Vistors Center.** Kroner, W.M. (Rensselaer Polytechnic Institute (RPI), Troy, NY). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30350.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

RPI's Visitor's Information Center includes passive solar heating, cooling, and daylighting systems. Sixty-four percent of the annual heating load is supplied by solar energy; eighty percent of the annual cooling load is supplied by natural cooling; and, the daylighting contribution is sixty-one percent. The most innovative design elements are the building's multi-energy flow systems for heating, cooling, and daylighting constantly searching for free energy before actuating back-up systems. The energy systems are also integrated with personalized technologies designed to provide the occupants' sensory needs, rather than those of the building. The building applies familiar passive technologies in new ways, suggesting a new architecture, one that depends on a building's occupants, as well as its systems for energy conservation.

40577 (CONF-810832—, pp 4.42-4.44) **Community Center.** Beattie, M. (Rocks & Trees, Inc., Middletown Springs, VT). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40578 (CONF-810832—, pp 4.48-4.50) **Blake Avenue College Center.** Dobrovolny, P. (Colorado Mountain Coll., Glenwood Springs). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30331.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A facility to house the Glenwood Springs Community Education Center in two floors of classroom spaces and to house the administrative offices for the entire five county college district is discussed. Passive heating and cooling and daylighting details are described with emphasis on the communal atrium space. (MHR)

40579 (CONF-810832—, pp 4.51-4.54) **Overview of designs from the DOE passive commercial buildings program.** Kurkowski, T.L. (DOE Chicago Operations Office, Argonne, IL); Ternoey, S.E. Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The US Department of Energy (DOE) Passive Solar Commercial Building Program required designers to analyze conventional building predicted energy loads prior to the start of the passive solar design. Three examples are presented to show how designers translated the statement of the building energy problem to a design which solved that problem. Conclusions are extrapolated to other buildings.

40580 (CONF-810832—, pp 4.55-4.59) **Passive/hybrid solar commercial buildings program.** Shibley, R.G. (Dept. of Energy, Washington, DC). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40581 (CONF-810832—, pp 5.1-5.3) **State-of-the-art overview passive solar multifamily housing.** Pfister, P.J. (Architectural Alliance, Minneapolis, MN). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Architectural Alliance was selected by the Mid American Solar Energy Complex in September, 1980 to conduct a series of workshops on the Design, Construction, Financing and Marketing of Passive Solar Multi-Family Housing. Materials for presentation at the workshops and promotional materials were prepared in the period from October, 1980, through January, 1981. Six 2 1/2 day workshops were conducted in the MASEC Region from February through April, 1981. From the material presented at the workshops and follow-up survey letters sent to over 100 developers, designers and institutional representatives, it is evident that there is a significant interest in passive solar, energy efficient multifamily housing. The barriers to the wide spread use of passive solar appear to be largely institutional and to a smaller extent technical barriers.

40582 (CONF-810832—, pp 5.4-5.5) **Passive design concepts applied to multi-family construction.** Fitts, R.J. (Design Collaborative, Virginia Beach). Feb 1982. NTIS, PC A17/MF A01. Contract AC02-79CS30166.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A speculative townhouse-for-sale multifamily project was redesigned to include justifiable energy conserving and passive solar features. The project was not built due to adverse market conditions. (MHR)

40583 (CONF-810832—, pp 5.6-5.7) **Marketing passive & hybrid solar designs.** Eilert, B.L. (Lowe's Companies, Inc., N. Wilkesboro, NC). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The development of a Sunspace design, a solar water preheater design, and a passive solar home plan is described. (MHR)

40584 (CONF-810832—, pp 5.8-5.10) **Massachusetts multi-family passive solar program.** Rouse, R.E. (Commonwealth of Massachusetts, Boston). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The Office of Energy Resources has, to date, awarded passive solar grants totalling $1.2 million and conservation grants of $0.3 million using funds from its Energy Bond Program. 17 projects comprising over 400 passive solar heated apartments have already received awards. The projects represent a wide range of building types (from suburban cottages to mid-rise elevator buildings) and structural systems (from light wood to steel to concrete frames). They range from perfectly oriented solar townhouses to non-optimal buildings with highly constrained sites and difficult configurations (e.g. courtyards) or plans (e.g. double-loaded corridors). Apartments generally have one bedroom and a net floor area of about 520 square feet. Passive solar designs include simple direct gain windows, Trombe walls, breadbox water heaters, and unit, corridor, and stairtower sunspaces in a variety of configurations, some using remote storage.

40585 (CONF-810832—, pp 5.11) **Lumber dealer as the Energy Information Center.** Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40586 (CONF-810832—, pp 5.12-5.15) **Boston, site built air collector using heat mirror type glazing.** Hale, S.H. (Solar Guild Partnership, Belmont, MA). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A 450 square foot site-built air collector was completed in February of 1981 in Boston, Massachusetts. The collector uses the Guardian Glass Company's Passive Solar Glass with a selective surface coating on the inner lite of the collector's double glazing. The issues and theory that led to the building of the collector are discussed and performance for the system is estimated. Preliminary data taken in late winter indicates that the system will perform seasonally as predicted.

40587 (CONF-810832—, pp 5.16-5.17) **Solar cities and towns program.** De Serio, F. (Dept. of Energy, Washington, DC). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A program established to accelerate the introduction of large-scale active and passive solar energy and conservation projects of the urban building environment is described. (MHR)

40588 (CONF-810832—, pp 6.1-6.3) **Passive Cooling Experimental Facility hot/arid climate.** Peck, J.F. (Univ. of Arizona, Tucson). Feb 1982. NTIS, PC A17/MF A01. Contract AC03-80SF10816.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The Passive Cooling Experimental Facility consists of four test structures and a data acquisition building, each representing different construction techniques, incorporating different quantities and types of thermal mass, and illustrating different cooling options and combinations of passive sources of coolth. The performance of each cooling option will be determined based on comfort levels attained during differing ambient conditions in order to determine the upper limits of climate conditions where comfort will be provided. Structures one and two and the data acquisition building are currently under construction and will be ready for monitoring in August 1981.

40589 (CONF-810832—, pp 6.4-6.6) **Experimental investigation of thermally-induced ventilation in atria.** Leung, S.K.; Kazama, D.; Pierson, R.; Young, M. (Eureka Labs., Inc., Sacramento, CA). Feb 1982. NTIS, PC A17/MF A01. Contract AC03-80SF11511.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The atrium is defined for the purposes of this study. Worldwide historical uses of atria are described briefly. Technical principles, natural cooling mechanisms, and different configurations of atria are considered. Atria are classified in a three-dimensional scheme. (MHR)

40590 (CONF-810832—, pp 6.7-6.9) **Passive Cooling Experimental Facility for warm, humid climates.** Fairey, P.W. (Florida Solar Energy Center, Cape Canaveral, FL). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

In order to comprehensively examine low energy solutions to the cooling problem, FSEC has designed and is constructing a highly reconfigurable Passive Cooling Experimental Facility (PCEF) in Cape Canaveral, Florida. The primary goal is to provide a facility for the experimental testing, measurement, and analysis of residential passive cooling design and construction alternatives in Florida and other warm, humid climates.

40591 (CONF-810832—, pp 6.10-6.12) **Passive cooling by natural ventilation.** Chandra, S.; Fairey, P.W. (Florida Solar Energy Center, Cape Canaveral, FL). Feb 1982. NTIS, PC A17/MF A01. Contract AC03-80CS11510.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The six main tasks are reviewed: literature review and annotated bibliography; field experiments to obtain air change rates and airspeeds in six buildings; wind tunnel tests, on five models to determine surface pressure coefficients, airspeeds, air change rate, etc., for a variety of aperture/building geometrics, approach wind profiles and directions; numerical computation, using a three dimensional turbulent flow thermohydraulic code, to determine convective heat transfer coefficients at room surfaces; correlation of Task 4 results into a BLAST compatible subroutine and subsequent analysis with BLAST; and preparation of a design handbook for various US climatic zones.

40592 (CONF-810832—, pp 6.13-6.15) **Investigation of passive cooling techniques for hot-humid climates.** Akrdige, J.M. (Georgia Inst. of Tech., Atlanta, GA). Feb 1982. NTIS, PC A17/MF A01. Contract AC02-79CS30238.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The program has identified Detached Earth Tempering as a potentially promising concept for passive cooling in hot-humid regions. Computer similations have shown the concept to be capable of carrying a significant portion of the sensible cooling load. Experimental data now support the concept of cooling an insulated block of earth to well below the temperature of noninsulated soil at a similar depth. The study has also shown that buildings in hot-humid climates can be made to perform similar to buildings in hot-arid climates through the proper control of ventilation (infiltration). This greatly reduces the latent load normally associated with cooling in hot humid climates. The study has also shown the feasibility of radiantly cooling above ground buildings using water cooled by an underground block of earth which was cooled the previous winter.

40593 (CONF-810832—, pp 6.19-6.23) **State of the art in passive cooling.** Martin, M.R. (Lawrence Berkeley Lab., CA). Feb 1982. NTIS, PC A17/MF A01. Contract W-7405-ENG-48.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Passive cooling encompasses a number of natural heat rejection mechanisms including ventilation, evaporation, cooling by infrared transfer to the sky, and earth contact cooling. These topics are addressed in order to identify the overall state of development of each technology and to point out some of the problems remaining to be solved. A small subset of the system types of relevance are discussed and only a general overview of the topic is provided.

40594 (CONF-810832—, pp 6.24-6.26) **State of the art in passive solar heating.** Balcomb, J.D. (Los Alamos National Lab., NM). Feb 1982. NTIS, PC A17/MF A01. Contract W-7405-ENG-36.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The state-of-the-art is outlined according to four major categories: passive solar practice; performance evaluation; design aids; and products and materials. Needed future research activities an suggested joint industry/government activities are listed. (MHR)

40595 (CONF-810832—, pp 6.27-6.29) **Toward a warranty of no heating or cooling bills - ever.** Hay, H.R. (Skytherm Processes and Engineering, Los Angeles, CA). Feb 1982. NTIS, PC A17/MF A01. Contract FG03-78CS31825.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Modifications and improvements on the Atascadero Skytherm house are described. Experience in materials development, fabrication and installation quality control, certification, and cost analysis is discussed. (MHR)

40596 (CONF-810832—, pp 6.30-6.32) **Vindicating a proved system for 100% natural thermal control.** Hay, H.R. (Skytherm Processes & Engineering, Los Angeles, CA); Aiello, D.P. Feb 1982. NTIS, PC A17/MF A01. Contract FG03-77CS31842.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Principles of roof pond heating and cooling with movable insulation were established in a test room in Phoenix, Arizona. Current and tested ideas were assessed: two composite designs were developed for on the ground accelerated testing. Experience with a residence using the Skytherm roof pond is reviewed. (MHR)

40597 (CONF-810832—, pp 6.33-6.35) **National assessment of passive cooling processes and their application in cooling of buildings.** Clark, G.; Loxsom, F.; Treat, C.H. (Trinity Univ., San Antonio, TX). Feb 1982. NTIS, PC A17/MF A01. Contract AC03-77CS31600.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A regional assessment of natural process heat dissipation rates is planned. A variety of glazed and tilted heat dissipation surfaces will be considered, but special attention will be given to unglazed, horizontal, wet and dry surfaces. The project also includes a feasibility assessment of natural cooling systems for residences. A detailed performance analysis will be conducted for naturally cooled residences utilizing roof ponds, plastic and glass glazed tilted surfaces and rock bins.

40598 (CONF-810832—, pp 6.36-6.38) **Passive cooling and solar heating residential scale testing for warm humid climates.** Doderer, E. (Trinity Univ., San Antonio, TX). Feb 1982. NTIS, PC A17/MF A01. Contract AC03-79CS30201.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Thermal simulations were used to identify a variety of passive heating and cooling systems with commercialization potential in warm humid climates. Assessments of cooling rates as functions of local climate variables such as dry bulb temperature, humidity, windspeed, and cloud cover have been made. Uncertainties in thermal behavior generated the requirement for full scale testing. Commercially promising passive systems were selected for experimentation that passive cooling and space coupling processes could be adequately understood and design guidance could be provided for development of cost effective passive cooling/solar heating systems.

40599 **(DOE/R5/10138—2) Primary solar-heat system for winter camp. Final project report.** (Lake Agassiz Camp Fire Council, Moorhead, MN (USA)). Aug 1980. Contract FG02-79R510138. 5p. NTIS, PC A02/MF A01. Order Number DE82008786.

A 400 ft^2 solar air heater is installed on the roof of a winterized camp lodge. An air vent in the ceiling of the kitchen feeds room air into the bottom of the collector and a duct and fan system draws warmed air from the system into a rock storage area underneath the lodge. The collector is designed to maintain a temperature of 35 to 40 degrees in the lodge were on the coldest days to prevent the plumbing from freezing up. (MHR)

40600 **(DOE/SF/11485—1) Assessment of the field status of active solar systems.** (Institute of Public Administration, Washington, DC (USA)). Feb 1982. Contract AC03-80SF11485. 87p. NTIS, PC A05/MF A01. Order Number DE82011939.

This assessment of the active solar industry represents a consensus of findings and recommendations by a team of experts from basic data gathered through first-hand interviews with over 150 industry people in various parts of the country. Domestic hot water systems are emphasized. The following are included: industry description, product problems, and marketing. (MHR)

40601 (DOE/SF/11485—T1-Vol.2, pp 52p, Paper 2) **Solar equipment testing, codes, and standards solar status assessment team report.** Pulliam, E.R. Jan 1982. NTIS, PC A10/MF A01.

In Assessment of the field status of active solar systems. Volume 2. Appendices. Final report.

The existing equipment and systems testing, health and safety codes, and industry standards programs are reviewed. The needs, such as a simple sizing methodology and solar access protection, are pointed out.

40602 (DOE/SF/11485—T1-Vol.2, pp 72p, Paper 3) **Analysis of reliabilty and maintainability of residential and commercial solar systems included in the national solar heating and cooling demonstration program.** Greenberg, J.; Berry, S.; Chen, P.; Cooke, P.; Yancy, C. (National Bureau of Standards, Washington, DC). Jan 1982. NTIS, PC A10/MF A01.

In Assessment of the field status of active solar systems. Volume 2. Appendices. Final report.

The operational history of those solar installations included in the National Solar Heating and Cooling Demonstration Program is reviewed and documented. Emphasis was placed on (1) failures reported after each system became operational, (2) the time frame in which the failure occurred, and (3) the effect of the failure on system operation. The study covered systems installed in both the residential and commercial programs. (MHR)

40603 **(EUR—7077-EN) Passive solar heating with heat storage in the outside walls.** Baehr, A.; Piwecki, H. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 27p. European Community Information Service, 2100 M Street, N.W., Suite 707, Washington, DC 20037.

Four construction types of solar collector storage units were tested during the winter season 1979/80. The units consist of a water vessel for heat storage and a structure positioned on its outside, which acts as a solar collector and a thermal insulation of the storage. The design is stipulated to completely cover the sufficiently irradiated parts of the outside walls of a building with those units. The building wall of bricks or concrete receives heat from the storage vessel and acts as the room heating surface. The performance of the four collector storage units and the differences in their operational behaviour are discussed.

40604 **(EUR—7343-EN) Second solar energy R + D programme (1979-1983), contractors meeting, January 1981.** Steemers, T.C. (ed.). (Commission of the European Communities, Brussels (Belgium). Directorate General for Research, Science and Education). 1981. 442p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

Presented are the proceedings of a coordination meeting of contractors in the Solar Energy Application to Swellings Project. In the area of solar cooling, topics reported include selective surfaces, high performance collectors, cooling machines and cooling plants. In the area of heat storage, topics covered include long term storage, latent heat and chemical stores. Concerted actions were reported in the areas of European modelling for solar heating systems and domestic hot water, solar pilot test facility, performance monitoring, collector testing, and passive solar heating. (LEW)

40605 **(PB—81-143166) Assessment of a semi-closed, renewable resource-based aquaculture system. Progress report No. 5.** Todd, J.H. (New Alchemy Inst., East Falmouth, MA (USA)). 22 Sep 1980. 111p. NTIS, PC A06/MF A01.

A schematic overview of solar aquaculture dynamics is presented using an informal model which guided the experimentation to impove overall system efficiency. Limitations of algal-based purification for acceptable winter fish yields in the Ark bioshelters proved problematic. Research suggests that (1) solar aquaculture in bioshelters can be successful during the winter season, and (2) system improvement can be assessed more effectively by expanded quantification of algae, bacteria, detritus, and total nitrogen flow. The outside experiments of late summer and fall, 1979, are summarized and the transition dynamics of the shift from algal to bacterial dominance of nitrogen pathways are further defined. Experiments are reported which represent quite different approaches to winter pond management - toxic inhibition versus biofilter and hydroponic purification. Detailed evaluations of management strategies are presented including a basic siphon strategy, a new bucket detritus removal strategy, and the first attempts at total nitrogen budgeting and assessment of bacterial interactions. An economic model of fish culture in solar-algae ponds is described.

40606 **(PB—81-187122) A collector sizing procedure for residential solar hot water systems with prescribed thermal performance requirements. Final report.** McCabe, M.E. (National Bureau of Standards, Washington, DC (USA)). 1980. 20p. Pub. in Proceedings of the ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Semiannual Meeting Held at Los Angeles, CA., on Feb 3-7, 1980, ASHRAE Transactions 86, pt1 p420-439 1980.

A graphical procedure was developed based on the f-chart design method to determine whether solar domestic water heating systems proposed for use in the HUD Hot Water Initiative Program have sufficient collector area to provide 50% of the load as prescribed by the thermal performance requirements of the Program. The procedure was specifically developed for the 11 states participating in the HUD initiative (the New-England and Mid-Atlantic States and Florida), however, it should be applicable for the sizing of the collectors for solar water heaters in other locations with similar climates.

40607 **(PB—81-210551) F-chart handbook. Active solar system sizing and economic analysis program.** Mielke, G.W. (Illinois Inst. of Natural Resources, Springfield (USA)). Apr 1981. 15p. NTIS, PC A02/MF A01.

F-Chart is a solar energy system analysis program developed at the University of Wisconsin. It is applicable to active solar space and service water heating systems that incorporate typical flat-plate solar collectors. The F-Chart Program is based on the F-Chart method of estimating annual system thermal performance. This program uses a standard life-cycle cost analysis methodology to calculate optimum solar system size and present economic performance data. The F-Chart program is designed to be used by anyone interested in, or involved with, solar heating systems. This handbook describes both information input requirements and the resultant thermal and economic analyses. Residents of the State of Illinois may submit a completed input form to the Illinois Institute of Natural Resources and will receive a printout detailing the analyses for a specified solar system.

40608 **(PB—82-100264) Two examples of passive solar retrofit for historic structures. Final report.** Metz, F.E. (National Bureau of Standards, Washington, DC (USA)). 1980. 2p. Proceedings of National Passive Solar Conference (5th), Amherst, MA., October 19-26, 1980, Extended Abstract in Passive Solar 1980, 5.2, p1305-1306 1980.

Passive application for existing buildings is a multi-faceted challenge. The retrofit of structures in historic districts compounds this challenge. In spite of the many problems, the greatest potential for passive/hybrid applications may be within the vast abundance of our existing buildings.

40609 **(PB—82-103847) Evaluation of residential and commercial solar/gas heating and cooling technologies. volume i: program overview. Final report dec 79-jan 81.** Hirshberg, A.S.; Haas, S.A.; Jacobsen, A.S. (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). Dec 1980. Contract GRI-5014-345-0280. 64p. NTIS, PC A04/MF A01.

The technologies and economics of solar/gas systems are evaluated for application in the single-family residential market and in the small (individual building) commercial market. The analysis considered such important factors as the effects of solar industry maturity on system costs and the impact of solar incentives and natural gas price uncertainties on solar/gas system economics, and it compared projected solar/gas systems with advanced conventional gas equipment such as pulse combustion furnaces.

40610 **(PB—82-103854) Evaluation of residential and commercial solar/gas heating and cooling technologies. volume ii. Final report dec 79-jan 81.** Hirshberg, A.S.; Haas, S.A.; Jacobsen, A.S. (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). Dec 1980. Contract GRI-5014-345-0280. 287p. NTIS, PC A13/MF A01.

The economics of the most cost-effective solar/gas hybrid systems against a range of advanced gas-fired space conditioning equipment, including both conventional gas furnaces and pulse combustion gas furnaces were analyzed. In addition, the economic comparison considered improvements in performance and cost reduction for both solar/gas systems and advanced gas-fired equipment.

40611 **(PB—82-109216) Development of equipment for heat treating internally sealed concrete - Phase I. Final report.** (Midwest Research Inst., Kansas City, MO (USA)). 8 Dec 1977. Contract DOT-FH-11-9317. 96p. NTIS, PC A05/MF A01.

The addition of monomers or the inclusion of wax within highway bridge decks are two methods being used to prevent salt penetration during winter deicing. Both of these methods require the addition of heat until the upper two inches of the concrete deck reaches 160-190 F. This study developed concepts for both a solar powered and a solar assisted system for heat treating internally sealed concrete. The heat transfer characteristics of reinforced portland cement concrete were analyzed, and the critical parameters of thermal diffusivity and conductivity determined. Solar isolation data was collected from six areas of the country during months typical of the construction season, and correlated with ambient temperatures and wind data for the same locations and periods, in order to derive both the net energy input available and the net energy requirement of the system. Three configurations of flat plate solar collectors were investigated and computer analyzed to determine their ability to satisfy the system requirements. A modular collector system was recommended on the basis of its anticipated durability and longevity, ease of handling, and overall lower life-cycle cost. The design was optimized and computer simulations were run on the system to evaluate performance in typical U.S. cities.

40612 **(PB—82-109299) Experimental investigation of solar heating bridge decks. Final report 1 Apr 77-30 Jun 79.** Francis, J.E.; Love, T.J.; Calvert, F.O.; Yao, L.P.; Zargar, A.M. (Oklahoma Univ., Norman (USA). School of Aerospace, Mechanical and Nuclear Engineering). Dec 1978. 127p. NTIS, PC A07/MF A01.

The addition of monomers or the inclusion of wax within highway bridge decks are two methods being used to prevent salt penetration during winter deicing. Both of these methods require the addition of heat until the upper two inches of bridge deck reaches from 160-190 F. This study investigated the potential for using solar energy as a means of providing the required heat. The bridge was modeled analytically and the time varying temperature distribution was determined for both a flat plate type cover collector and focusing tracking solar collection schemes. The models indicated the flat plate approach for typical summer conditions in Oklahoma was at best marginal but that the focusing collector scheme did show promise for providing the required heat. Both models suffered from lack of accurate thermal properties data for the concrete. Experimental studies were conducted on a simulated bridge deck using flat plate covers and Northrup focusing Fresnel Lens collectors. Neither scheme was able to provide the desired temperatures. A major difficulty encountered was the design of an appropriate heat exchanger to transfer the collected energy from the heat transfer fluid to the bridge deck. Several different designs were tested, but none of the methods used would provide the desired bridge deck temperatures for the collector area used. The collectors did not perform up to their expectations.

40613 **(SSEC/SP—32266) Solar-heated municipal swimming pools, a case study: Dade County, Florida.** Levin, M. (Southern Solar Energy Center Planning Project, Atlanta, GA (USA)). Sep 1981. Contract AC02-79CS30166. 11p. NTIS, PC A02/MF A01. Order Number DE82009475.

Portions of document are illegible.

The experience of installing a solar energy system to heat the water in the swimming pool in one of Dade County, Florida's major parks is described and the mechanics of solar heated swimming pools are explained. The solar heating system consists of 216 unglazed polypropylene tube collectors, a differential thermostat, and the distribution system. The performance and economics of the system are discussed as well as future plants. (LEW)

40614 **Interrelation between recurrent and capital costs in a solar thermal process heat system.** Lukens, L.L.; Schimmel, W.P., Jr. (Sandia Laboratories, Albuquerque, NM). *Journal of Solar Energy Engineering;* **103**: 241-243(Aug 1981).

The effect of operation and maintenance (O M) costs on energy produced by solar collector systems is crucial to the market penetration of solar process heat as an alternative energy source. In the present paper, a particular O M operation, regular collector cleaning, is considered in order to determine its effect upon annualized life cycle energy cost. A first-order model of mirror reflectance degradation as a function of time is constructed from experimental data. This is used as input to a systems optimization model of a line-focus solar collector process heat installation. The energy cost variation is considered as a function of cleaning cost per unit of collector aperture and cleaning interval. Results are presented for a process heat temperature of 177 C.

40615 **Solar cooling by use of desiccants.** Robinson, H.I.; Houston, S.H. (Univ. of South Carolina, Conway). pp 25 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40616 **Three and a half ton solar absorption air conditioner's performance in Riyadh, Saudi Arabia.** Sayigh, A.A.M.; Khoshaim, B.H. (Univ. of Riyadh, Saudi Arabia). pp 49 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40617 **Improved solar cooling system.** Mehta, G.D. (Intertechnology/Solar Corp., Warreton, VA). pp 51 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40618 **Use of concentrators in solar power plants.** Guastini, G. (AMN, Genoa, Italy). pp 79 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40619 **Design limitations of solar refrigeration systems of ammonia-water absorption type for very low temperature application.** Huang, B.J. (National Taiwan Univ., Taipei). pp 81 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40620 **Options for cooling using solar energy from flat plate collectors.** Alt, T.E. (Ingenieur Associates, Phoenix, AZ). pp 111-112 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40621 **Earth coupled heat pump.** Edwards, J.A. (North Carolina State Univ., Raleigh). pp 113 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40622 **Solar absorbent for solar regenerative air drying cooling systems.** Theisen, J.A. (Solsorce, Appleton, WI). pp 181 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40623 **Thermodynamic humidity control through architecture.** Bowen, A. (Univ. of Miami, Coral Gables, FL). pp 185 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40624 **Passive energy systems in Persian and Islamic architecture.** Elmer, D.B. (Dept. of Energy, Washington, DC). pp 187 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40625 **Passive systems for rural areas in developing countries.** Elmer, D.B. (Dept. of Energy, Washington, DC). pp 191 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40626 **Solar driers.** Chacko, V.P.T. pp 193-194 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40627 **Modeling of solar drying.** Kumar, R.; Mallan, K.V. (M.N.R. Engineering Coll., Allahabad, India). pp 195-196 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40628 **Finite-difference technique for the analysis of a solar drier.** Kamaraj, G. (Indian Inst. of Tech., Madras). pp 215-216 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40629 **Earth heat pump systems.** Goeteborg, Sweden; Chalmers University of Technolog. Earth Heat Pump Group (1979). vp. (CONF-7910128—).

From Nordic symposium on earth heat pump systems; Goteborg, Sweden (15 Oct 1979).

Separate abstracts were prepared for papers presented at this meetings.

40630 **(DOE/CS/32125—T1) Narrative description of building and solar energy system.** (Shaw Construction Co., Denver, CO (USA)). [nd]. Contract FC03-78CS32125. 7p. NTIS, PC A02/MF A01. Order Number DE82008820.

The following are included: a narrative description of building and solar energy system, lessons learned, recommendations, and verification statement. The building includes 2840 ft² of offices on two floors and 2360 ft² of full-height warehouse area. Thirty-six Solaron rooftop mounted collectors are used with rock bed heat storage. (MHR)

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 40549, 40586, 40612, 40614

40631 **(BMFT-FB-T—80-045) Cleaning system for solar energy collectors. Final report.** Wack, O.K. (Wack (Oskar K.) Chemie G.m.b.H., Ingolstadt (West Germany)). Aug 1980. 30p. NTIS, PC A02/MF A01.

Reduction of light transmission caused by soiling of solar energy collectors was measured under laboratory conditions. The magnitude of possible energy losses was determined. Glass slides (30 X 55mm) were soiled with three different test dirts. The energy losses vary between 9% and 20%, depending on soil load (0.4 to 0.9 g/sq m) and soil type. Given the significance of these results, their verification by testing glass surfaces soiled under outdoor conditions is proposed. The development of a prototype automatic cleaning system for solar energy collectors is also suggested. A literature search shows no reference to research on the soiling problem of solar energy collectors. (ESA)

40632 (DOE/SF/11485—T1-Vol.2, pp 68p, Paper 1) **Materials and corrosion considerations in active solar heat systems.** Giner, J.; Cocks, F.H. (Giner, Inc., Waltham, MA). Jan 1982. NTIS, PC A10/MF A01. Contract AC03-80SF11485.

In Assessment of the field status of active solar systems. Volume 2. Appendices. Final report.

The range of materials and corrosion problems, either encountered or anticipated, in current systems are reviewed critically with emphasis on materials degradation under the special and demanding conditions of solar heating as opposed to normal domestic hot water and space heating systems. A selected bibliography of available relevant reports and studies is included.

40633 **(EUR—7307-EN) Short-interval meteorological data for computational methods. Final report.** Koch, H.R.; Grueter, J.W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). 1981. 31p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The fundamental question of validation of computational methods for the determination of the energy output of collectors is dealth with. The question of the necessary lengths of time intervals of meteorological measurements is studied with the help of a dynamic collector description in terms of finite elements. It is shown that time intervals less than 1 hour are not substantial for the computation of the energy output of flat plate collectors. With this result the request on shorter intervals of measurement for the solar radiation data acquisition networks is reduced in priority. Meteorological data were measured during the years 1978 and 1979, in intervals of 10 minutes. The measurement of global radiation on inclined surfaces was included.

40634 **(NASA-CASE-LEW—13132-1) Method of forming oxide coatings.** Mcdonald, G.E. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jun 1981. 7p. NTIS PC A02/MF A01.

This invention is concerned with an improved plating process for covering a substrate with a black metal oxide film. The invention is particularly directed to making a heating panel for a solar collector. A compound is electrodeposited from an aqueous solution containing cobalt metal salts onto a metal substrate. This

compound is converted during plating into a black, highly absorbing oxide coating which contains hydrated oxides. This is achieved by the inclusion of an oxidizing agent in the plating bath. The inclusion of an oxidizing agent in the plating bath is contrary to standard electroplating practice. The hydrated oxides are converted to oxides by treatment in a hot bath, such as boiling water. An oxidizing agent may be added to the hot liquid treating bath.

40635 **(NASA-CASE-NPO—15419-1) Stable density-stratification solar pond.** Lansing, F.L. (Jet Propulsion Lab., Pasadena, CA (USA)). Apr 1981. 15p. NTIS PC A02/MF A01.

A solar pond for collecting and storing solar thermal energy includes a container having one section characterized by an internal wall of a substantially cylindrical configuration and a second section having an internal wall of a substantially truncated conical configuration surmounting and in coaxial alignment with the first section. The second section is characterized by a base of a diameter substantially equal to the diameter of the first section and a truncated apex defining a solar energy acceptance opening. A body of immiscible liquids is disposed within the container and comprises a first portion substantially filling the first section of the container and a second portion substantially filling the second section of the container. The first portion is of a darker color than the second portion and of a greater density. A protective cover plant is removably provided for covering the acceptance opening.

40636 **(PB—81-247314) Snow accumulation on and around solar collectors. Final report.** Harris, J.R. (National Bureau of Standards, Washington, DC (USA)). 1981. 12p. Proceedings of the Eastern Snow Conference (37th) Held at Peterborough, Ontario, Canada on June 5-6, 1980, p54-65 1981.

Studies of the accumulation of snow and ice on buildings with flat plate solar collectors were carried out during the winter of 1979. Although the studies were generally qualitative, preliminary guidelines for snow load criteria were developed.

40637 **(PNL-SA—10169) Electroless nickel and ion-plated protective coatings for silvered glass mirrors.** Lind, M.A.; Chaudiere, D.A.; Stewart, T.L. (Pacific Northwest Lab., Richland, WA (USA)). 1982. Contract AC06-76RL01830. 19p. (CONF-820107—9). NTIS, PC A02/MF A01. Order Number DE82008566.

From SPIE optical coatings for energy efficiency and solar applications conference; Los Angeles, CA, USA (25 Jan 1982).

Two methods of protecting second surface silvered glass mirrors from environmental degradation have been evaluated. One method employed silver mirrors overcoated with Al, Ni, 304 stainless steel, Cr, and an Al/Cu alloy prepared by ion-plating. The other method used conventional wet process silver mirrors protected with a thin electroless nickel coating. These mirrors were compared with conventional paint backed silver/copper mirrors after exposure to elevated temperatures and water vapor. The electroless nickel mirrors showed consistently more resistance to these stresses than either the conventional or ion-plated mirrors suggesting that they may provide more durable field service.

40638 **(UCRL—53213) Calorimetric measurements of emittance of pipe surfaces: influence of enclosure diameter, test pipe length, and an argon atmosphere.** Reitter, T.A. (Lawrence Livermore National Lab., CA (USA)). Oct 1981. Contract W-7405-ENG-48. 39p. NTIS, PC A03/MF A01. Order Number DE82009040.

Additional results using a calorimetric technique for measuring the total hemispherical emittance of pipe surfaces from 400 to 600 K are described. Two different Pyrex pipe enclosures were used, one of 15 cm i.d. and the other of 30 cm i.d. An error analysis showed that the larger diameter Pyrex pipe should have a smaller error, but the difference was negligible for the 4.4-cm test pipe diameter used. Measurements on a short length of a previously-measured pipe agreed with earlier measurements, but only over the temperature range of the measurements. While the technique normally uses a vacuum to minimize nonradiative heat transfer, measurements were done succesfully with an argon atmosphere in a closed system. A nickel-plated pipe, measured first in a vacuum and then in an argon atmosphere, allowed calculation of an effective convective heat-transfer coefficient for use with test pipes of unknown emittances. Measurements done with an atmosphere have larger uncertainties than those done in vacuum. Measurements using this technique agreed with measurements made using a reflectance technique. It is believed that within the range of temperatures measured, emittance measurements made using the calorimetric technique have a relative error of no more than 10% when done in vacuum.

40639 **(UCRL—53214) Design and operation of an apparatus for calorimetric emittance measurements of pipe surfaces.** Reitter, T.A. (Lawrence Livermore National Lab., CA (USA)). Oct 1981. Contract W-7405-ENG-48. 23p. NTIS, PC A02/MF A01. Order Number DE82008713.

A technique for the measurement of the total hemispherical emittance of pipe surfaces is described, and design and operational details are given. The technique is conceptually simple. A long test pipe (e.g., 3.4 m) is mounted concentrically inside a Pyrex glass pipe. The system is evacuated, and the test pipe is heated by means of an electrical resistance heater. Heat transfer from the test pipe to the enclosure is almost solely radiative, allowing an average emittance for the test pipe and the Pyrex pipe and the electrical power input to the heater. By varying the electrical power level, one can measure the test pipe emittance as a function of temperature. By using a simple correction to account for the finite length of the test pipe, one can calculate the results using the simple expression for infinite, concentric cylinders. Results agree with measurements by reflectance techniques and have a nominal relative error of less than 10%.

40640 **(VKI-LS—1980-2-VOL-2) Heat exchange and solar energy, Volume 2.** (Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium)). 1980. 337p. NTIS, PC A15/MF A01.

The heat transfer problems arising in connection with the collection, storage, and utilization of solar energy are examined. The treatment of solar and meteorological data, the instrumentation and measurement technique used to obtain them as well as mathematical models and operational characteristics of various solar heating systems and their individual components are covered. Special emphasis is given to the modeling of complete solar systems, including computer simulation of their transient response. Advantages and disadvantages of energy storage based on sensible heat, phase change, and chemical reaction, along with thermomechanical solar power generation and calculation of the thermal load requirement of buildings are discussed. An analysis of economic aspects and future prospects for solar energy utilization is made. For individual titles, see N81-20550 through N81-20559.

40641 **Ground solar collector system.** Chen, P.I. (Univ. of Petroleum and Minerals, Dhahran, Sandi Arabia). pp 53 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40642 **Basic heat and masstransfer research in solar energy.** Aung, W. (National Science Foundation, Washington, DC). pp 109 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

1420 Heat Storage

REFER ALSO TO CITATION(S) 40555, 40603, 40604, 40640, 40642, 40829, 40830, 40831, 40832

40643 (CONF-810832—, pp 3.6-3.9) **Long term ice storage for cooling applications.** Gorski, A.J. (Argonne National Lab., IL). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A full-scale outdoor test facility is now completed and awaiting the winter freezing season. This facility is fully instrumented and equipped with a new type of ice-freezing heat pipe fabricated from Roll-Bond panels.

40644 (CONF-810832—, pp 3.18-3.20) **Development of a passive thermal battery.** Bliege, C.L. (Hitek, Inc., Sweet Home, OR). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30523.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

A Passive Thermal Battery module which uses presently marketed phase change materials for thermal energy storage has been developed. The module system includes a control system which automatically operates shutters and a small fan to provide all modes of collection, storage and distribution and is used in conjunction with a conventional room thermostat. A computer model has been developed to optimize the design taking into account radiation heat transfer between module surfaces and the heat storage materials.

40645 (CONF-810832—, pp 3.38-3.40) **Thermal storage: the state of the art.** Kando, P.F. (NAHB Research Foundation, Inc., Rockville, MD). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Heat storage in materials with high specific heat and using the heats of fusion of materials is discussed. (MHR)

40646 (EUR—7266-EN) **Thermal energy storage systems. Part I.** O'Callaghan, P.W.; Smith, I.E.; Probert, S.D.; Bell, M.A. (Cranfield Inst. of Tech., Bedford (UK)). 1981. 140p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

Research into the viability of using saturated solutions of inorganic salts for thermal energy storage has shown that energy densities of between 2 and 4 times that of thermal storage in water are attainable over the temperature interval 30° to 70°C. The operation of a viable storage device using saturated solutions depends primarily on the ability to remove heat from the hot solution without its supercooling and without fouling of the heat exchanger. Two types of heat exchanger were demonstrated which effectively fulfilled these requirements, one used a fluidized bed of coarse particles, the other was continuously mechanically cleaned. A small sized (46 litre) thermal store was constructed and tested. Its measured thermal discharge performance showed a high degree of stratification and good agreement with predictions from a simple mathematical model. Its design appears to offer considerable scope for improvement and development in terms of thermal performance, reliability, and comparatively low cost.

40647 (EUR—7697-EN) **Optimization of heat-storage systems using silica gels. Final report.** Bougard, J.; Delire, C.; Jadot, R. (Faculte Polytechnique de Mons (Belgium)). 1982. 120p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The mathematical model and computer program simulating the behavior of the silica gel packed-bed are described. The program gives the humidity and temperature of outlet air related to physico-chemical properties of silica gel and inlet conditions. The theoretical values and experimental measurements are in agreement. Three possible configurations of heat storage system using silica gel are studied. The first involves mixing the hot dry air with the humid tepid air from the saturator. The second heats the cold humid air from the outside with the hot dry air in a heat exchange. The third is a hot water system instead of a hot air space heating system. The heat is extracted directly from the packed-bed with an air-water exchanger. It is demonstrated that the first is the most advantageous, and a technico-economically optimized system is made. The microscopic physico-chemical properties are examined and microscopic and macroscopic properties of silica gel are linked. The influence of the method of preparation of the silica gel and its microscopic properties are pointed out. (LEW)

15 GEOTHERMAL ENERGY

40648 (DOE/NV/10177—1) **Multiple-task services for the Division of Geothermal Energy's hydrothermal-resources program. Annual report, November 1980-October 1981.** (Gruy Federal, Inc., Arlington, VA (USA)). Jan 1982. Contract AC08-81NV10177. 17p. NTIS, PC A02/MF A01. Order Number DE82009007.

Work performed on two general tasks, resource definition and technical assistance, is reviewed briefly. (MHR)

40649 (PB—81-856700) **Economic analysis of geothermal resources, power plants, and district heating. January 1970-December 1980 (citations from the NTIS Data Base). Report for January 1970-December 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 138p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning economic analysis and comparative evaluations for geothermal resource discovery, development, and exploitation and for geothermal industry technology. Some attention is given to specific geographic locations and applications for geothermal resources, power plants, and district heating as well as to general considerations of these topics. (Contains 104 citations, fully indexed and including a table of contents.)

40650 (PB—81-856718) **Economic analysis of geothermal resources, power plants, and district heating. January 1976-December 1980 (citations from the Energy Data Base). Report for January 1976-December 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 188p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning economic analysis and comparative evaluations for geothermal resource discovery, development, and exploitation and for geothermal industry technology. Some attention is given to specific geographic locations and applications for geothermal resources, power plants, and district heating as well as to general considerations of these topics. (Contains 165 citations, fully indexed and including a table of contents.)

1501 Resource Status And Assessment

REFER ALSO TO CITATION(S) 40661

40651 (DOE/RA/50075—T12) **Geothermal energy in Nevada.** (Nevada Dept. of Energy, Carson City (USA)). 1980. Contract FC03-80RA50075. 20p. NTIS, PC A02/MF A01. Order Number DE82009065.

The nature of goethermal resources in Nevada and resource applications are discussed. The social and economic advantages of utilizing geothermal energy are outlined. Federal and State programs established to foster the development of geothermal energy are discussed. The names, addresses, and phone numbers of various organizations actively involved in research, regulation, and the development of geothermal energy are included. (MHR)

40652 (NP—2903386) **Geothermal resources and technology in the United States. Supporting Paper No. 4.** (National Research Council, Washington, DC (USA). Committee on Nuclear and Alternative Energy Systems). 1979. 63p. National Academy of Sciences, Office of Publications, 2101 Constitution Ave. N.W., Washington, DC.

The types of geothermal resources and their energy contents and producibility are reviewed. The production method and costs, production rates, and prerequisites of development are discussed. (MHR)

40653 **(NP—2904111) New Mexico's energy resources '81. Annual report of Bureau of Geology in the Mining and Minerals Division of New Mexico Energy and Minerals Department.** Arnold, E.C.; Hill, J.M. (comps.). (New Mexico Energy and Minerals Dept., Santa Fe (USA)). 3 Sep 1981. 62p. New Mexico Energy and Minerals Dept., Santa Fe, NM $4.00.

Portions of document are illegible.

Although production of U_3O_8 declined only slightly in 1980, New Mexico's share of domestic production has declined from 48% in 1976 to 35% in 1980. Production projections indicate a continued decline in 1981 and lower production until at least 1984. New Mexico has 41% of total domestic reserves producible in the $50-per-lb cost category. In keeping with the anticipated steady depletion of reserves, production of crude oil in New Mexico was 69.9 million bls, a 6.3% decline in production from 1979. Condensate production of 5.4 million bbls in 1980, however, represented an increase of 7% from 1979 production. Although natural gas production was the lowest since 1970 and declined by 2.6% from 1979 production, 1980 was the 15th year that production exceeded 1 trillion cu ft. Despite declines in production, the valuation of oil and gas production has increased significantly with oil sales doubling from the previous year and gas sales increasing by $409 million because of higher prices. Reserves have been estimated to be 959 million bbls of crude oil and 17.667 trillion cu ft of natural gas. Production of 19.5 million short tons of coal in 1980 represented a 33% increase over 1979 production and an increase of 157% since 1970. Coal resources in New Mexico are estimated to be 180.79 billion short tons, and production is projected to incease to 39.61 million tons in 1985 and 67.53 million tons in 1990. The most notable developments in geothermal energy have been in technical advances in drilling, testing, and applications, especially in the area of hot dry rock systems. The US Bureau of Land Management has issued 113 geothermal leases that remain active. Recent geothermal exploration activity has been detailed for 21 companies.

40654 **European HDR case: where to go next. An assessment of methodology by the working party on Hot Dry Rock research and technology set up by the Commission of the European Communities.** Luxembourg; Commission of the European Communities (1981). 54p. (EUR—7361-EN). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

A working party set up by the Commission of the European Communities has assessed the state of the art of Hot Dry Rock research, development and technology; specified the work needed to further evaluate the feasibility of the HDR issue; and stated recommendations for European research, including suggestions for projects and sites. The Hot Dry Rocks discussed in this study are hot dry and impervious basement rocks in which a heat carrier fluid should be circulated.

40655 **Geothermal resources of Washington.** Olympia, WA; Washington State Energy Office (1981). vpp. Washington State Energy Office, Olympia.

1502 Geology And Hydrology Of Geothermal Systems

40656 (DOE/ID/01717—3, pp 1.1-1.5) **Public and technical geothermal resources of New Mexico maps.** Swanberg, C.A. (New Mexico State Univ., Las Cruces). Jan 1982. NTIS, PC A14/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1981. Final technical report.

The purpose of the present study is to compile all of the geological, geophysical, and geochemical data pertaining to geothermal energy resources and to use these data in compiling a series of geothermal resource maps for the state of New Mexico. The map package consists of a user-oriented public map designed for use by the general public, and a series of technical maps designed primarily for use by the scientific community.

40657 (DOE/ID/01717—3, pp 3.1-3.8) **Updating of New Mexico seismic data.** Sanford, A.R. (New Mexico Inst. of Mining and Tech., Socorro). Jan 1982. NTIS, PC A14/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1981. Final technical report.

Lists of origin times, epicenters, and magnitudes from listed reports and organizations were searched for New Mexico earthquakes whose local magnitudes (M/sub L/) equaled or exceeded 1.5, which is the minimum magnitude event considered in previous compilations (Sanford, Olsen, and Jaksha 1981). The magnitudes calculated by LANL, USGS, and ASL were reduced by 0.5 units to conform with magnitudes determined by the group at NMT. The 0.5 difference in magnitudes was established in an earlier study by Sanford, Olsen, and Jaksha (1981). Because the available listings of earthquakes did not provide complete coverage of the state, particularly the southern half, seismic records and listed seismic readings from several sources were examined for possible New Mexico earthquakes. Approximately 60 additional seismic events were investigated but most were rejected from the final listing because the magnitudes were less than 1.5 or the epicenters were outside the boundaries of the state. Parameters for New Mexico earthquakes (with local magnitudes, M/sub L/ $\geq$ 1.5) that occurred in the three-year interval, 1978 through 1980, are given. Also listed are the organizations whose epicenter coordinates, origin times, and magnitudes were used. In general, if an earthquake had an epicenter within either the ASL or the LANL arrays, the epicenters determined by those organizations were selected. In several cases, data from ASL and LANL were combined with a few additional readings and an epicenter was calculated by NMT.

40658 (DOE/ID/01717—3, pp 4.1-4.21) **Lineament map of the State of New Mexico.** Lepley, L. (US Geological Survey, Tucson, AZ). Jan 1982. NTIS, PC A14/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1981. Final technical report.

Ninety-one Landsat images were interpreted to produce a 1:500,000 scale lineament map of the state of New Mexico. This lineament map was then interpreted with the aid of published literature and available maps of gravity anomalies, temperature, Quaternary faults, geology, tectonics, and seismicity. Following the model of Chapin and Cather (1981), a Cenozoic plate tectonic history of New Mexico was developed. A time-series of four tectonic maps of New Mexico was constructed to illustrate the plate tectonic evolution of New Mexico from the Paleocene Epoch to the present. The significance of the lineament map and the plate tectonic model to geothermal exploration was analyzed.

40659 (DOE/ID/01717—3, pp 8.1-8.93) **Hydrologic study of the Animas Valley: Lightning Dock KGRA areas.** Hawkins, D.B.; Stephens, D.B. (New Mexico Inst. of Mining and Tech., Socorro). Jan 1982. NTIS, PC A14/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1981. Final technical report.

The hydrogeothermal data base in the Lightning Dock KGRA are updated and a computer model was applied for studying the general hydrologic behavior of the shallow aquifer system. The feasibility of applying the kriging technique to the calibration of a steady-state aquifer flow model is studied. (MHR)

40660 **(EUR—7100-DE) Laacher Lake volcanic magma-chamber and hot dry rock project Rieden (East Eifel). Final report.** Schmincke, H.U.; Woerner, G.; Risse, R.; Bogaard, P.V.D.; Viereck, L. (Bochum Univ. (Germany, F.R.)). 1981. 13p. (In German). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Beneath the Laacher Lake, a cooling magma reservoir of a minimum size of 25 km^3 exists. Examination of the upper part of the erupted magma column from the primary magma pool shows that it is composed of three clearly differentiated zones. These have been studied by neutron activation analysis. Calculations show that amounts of magma of the order of 8.1×10^9t were ejected during the Laacher Lake volcano activity besides 1.9×10^9t of other rocks in fragmented form. Results of investigations of the Rieder volcanic complex, which is regarded as an ideal test area for a hot dry rock study, are summarized. At least three phases of eruptions from one or more centres have been determined, resulting in intrusions, two of which are of similar age and mineral type. 2 figures, 1 table.

40661 (EUR—7275-EN) **Investigation of the geothermal potential of the UK: a preliminary assessment.** (Institute of Geological Sciences, London (UK). Geophysics and Hydrogeology Div.). 1981. 68p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

Geologically, Britain is an extremely stable area without active volcanism. In this situation the development of geothermal resources depends upon the occurrence of permeable rocks in deep sedimentary basins or the successful development of the hot dry rock concept. The average geothermal gradient is about 25°C/km, but two belts of above average heat flow extend across northern and south-western England. In these areas the gradient can be 30°C/km or more. The principal aquifers occur in the Mesozoic and the greatest geothermal potential is in sandstones of the Permo-Triassic where their occurrence at depth coincides with the high heat flow belts. This situation exists in several major Mesozoic basins, including the East Lincolnshire, the Wessex, the Cheshire, the West Lancashire and the Carlisle basins and also the basins in Northern Ireland. Currently, the Northern Ireland and Cheshire basins offer the best prospects of developing geothermal resources as the Permo-Triassic sequence has been proved at appropriate depths and thicknesses. Prospects in the southern part of the Wessex Basin are also good. The principal surface manifestations of geothermal activity in the UK are in Carboniferous rocks at Bath and Bristol, where the relatively high temperatures are caused by the deep circulation of meteoric waters. The best prospects for the application of the hot dry rock concept appear to be in Caledonian and Hercynian granites that have high radioactive heat productions.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 40653, 40656, 40671

40662 (DOE/ID/01717—3, pp 2.1-2.21) **Locating geothermal anomalies using bottom-hole temperatures from oil and gas wells in New Mexico.** Chaturvedi, L. (New Mexico State Univ., Las Cruces). Jan 1982. NTIS, PC A14/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1981. Final technical report.

This study involved: (1) collecting data on the location, depth, and bottom-hole temperature for each well; (2) drawing depth versus temperature plots using bottom-hole temperatures and the depths of measurement; and (3) computing a temperature gradient for each well using the bottom-hole and projected surface temperatures. A map showing computed anomalous geothermal gradients for New Mexico was also prepared.

40663 (DOE/ID/01717—3, pp 5.1-5.20) **Collection of existing water well data in the southern Rio Grande Rift and southwestern New Mexico.** Lohse, R.L. (New Mexico Energy Inst., Las Cruces). Jan 1982. NTIS, PC A14/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1981. Final technical report.

In order to identify existing water wells suitable for temperature logging in southwestern New Mexico, 98 well sites were located by topographic map inspection and field reconnaissance in the counties of Dona Ana, Grant, Hidalgo, Luna, and Sierra. During the fall of 1980 and the spring of 1981, each site was visited to identify those wells that could be logged. Of the 98 well sites, 59 were found to be operating wells which were closed and could not be logged, 16 were abandoned but not suitable for temperature logging, nine were suitable for logging but not immediately accessible, 13 were logged, and one flowing well was measured for water temperature. The 16 abandoned wells not suitable for temperature logging had pipes or pumps left in the well, or had broken casings or cave-ins. The high probability of losing the temperature-logging cable and probe prohibits the use of this equipment in potentially hazardous wells of this type.

40664 (DOE/ID/01717—3, pp 6.1-6.47) **Temperature gradient, resistivity, and magnetic surveying on the West Mesa of Albuquerque.** Jiracek, G.R. (San Diego State Univ., CA). Jan 1982. NTIS, PC A14/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1981. Final technical report.

The current geothermal studies in the Albuquerque area concentrated on the western side of the city, which is an area of anticipated growth. The warmest municipal groundwater temperature (32°C in 360 m deep West Mesa No. 1 was reported in this area by Bjorklund and Maxwell (1961). Resistivity investigations in the Albuquerque area consisted first in 1979 of Schlumberger and combined Schlumberger-equatorial soundings at three locations, S1, S2, and S3. The soundings were followed in the same year by bipole-dipole mapping from two orthogonal bipole transmitter pairs BD1 and BD2. Two dipole-dipole lines DD1 and DD2 were measured in 1980; the results are discussed. Surface magnetic profiles totaling 171 km were occupied as a portion of the current work. These profiles followed initial measurements of less than 10 km length made in 1980. Shallow (<30 m) temperature gradient measurements were made on the Llano de Atrisco during 1979 and 1980. Some anomalously high values (>100°C/km) in the shallow drillholes identified the need for deep gradient values, particularly below the water table. These measurements are currently being made in two holes that are 272 and 558 m deep. Preliminary data from these water monitor wells, drilled in the summer of 1981 by the US Geological Survey and the City of Albuquerque with our cooperation, are presented.

40665 (DOE/ID/01717—3, pp 7.1-7.36) **Resource assessment in southwest New Mexico (Catron, Dona Ana, Grant, Hidalgo, Luna, and Sierra Counties). Part 1. Electrical resistivity studies.** Young, C.T. (Michigan Technological Univ., Houghton). Jan 1982. NTIS, PC A14/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1981. Final technical report.

The Rio Grande Rift is tectonically active, thermally anomalous, and distinguished throughout its length by the combination of high heat flow, recently active volcanoes, exceptionally deep basins and late Quaternary faulting. Thus, the area has the potential for geothermal resources. Direct-current electrical resistivity soundings, using the Schlumberger array, are often employed for groundwater and geothermal reconnaissance. The sources of data used for this analysis are given in the figure captions and text as the data are discussed. These data sets and other electrical studies are included in an index map and bibliography prepared by Jiracek (1980b). Many of the cited studies were too shallow to be useful for geothermal studies. Notable exceptions are the deep penetration magnetotelluric studies by Geotronics Corporation (1979). These measurements penetrate tens of miles into the earth and are capable of detecting gross structures which are probably responsible for the high heat flow observed in New Mexico. Geotronics Corporation has conducted magnetotelluric measurements along a line from El Paso to the Animas Valley and in a grid on the Jornado del Muerto near Truth or Consequences. These data are proprietary.

40666 (E—81-10119) **Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain.** Delascuevas, R.N. (Univ. Politecnica de Madrid); Desagredo, D.F.L. (Valencia Univ.); Miralles, D.J.M. (Univ. Complutense); Araujo, D.P.H. (Centro de Estudios Hidrograficos, Madrid); Perlado, D.J.P. (Inst. Espanol de Oceanografia, Madrid); Parrilla, D.G. (Centro de Investigacion, Madrid); Picon, D.J.L. (Consejo Superior de Investigaciones Cientificas, Madrid). (Instituto Geografico Nacional, Madrid (Spain)). Jun 1980. 3p. NTIS PC A02/MF A01.

Although no significant results were achieved during the report period, research continues. A sample of imagery showing thermal inertia and temperature differences over the northeastern United States and Europe was received. The project coordinator attended a TELLUS Project meeting in Ispra, Italy at which general guidelines for the future were established and the quality of the data received was discussed.

40667 (EUR—7276-EN) Investigation of the S.W. England thermal anomaly zone. Final report. Wheildon, J.; Francis, M.F.; Ellis, J.R.L.; Thomas-Betts, A. (Imperial Coll. of Science and Technology, London (UK)). 1981. 410p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The use of specially drilled shallow heat flow boreholes as a reconnaissance technique for potential Hot Dry Rock geothermal resources has been demonstrated. Twenty three boreholes have been drilled in and around the Cornubian granite batholith. In addition, almost as many boreholes drilled by mining companies and the Institute of Geological Sciences have been taken over for heat flow determinations. Temperature logs have been made and thermal conductivities determined for the majority of these boreholes. Gamma-ray spectrometric determinations of the radiogenic elements, potassium, uranium and thorium have been made on over three hundred representative borehole samples. Anomalously high values of heat flow (120 mWm^{-2}) were observed at all sites on or adjacent to the granites, while normal heat flow (around 60mWm^{-2}) was determined at sites remote from the granite. The possibility of enhancement of heat flow through convective circulation at depth, which had earlier been thought to be the case, is virtually ruled out by the uniformly high values over the entire batholith. Using model studies, the observed sharp contrasts of thermal conductivity and heat production, combined with the likely space-form of the batholith, are demonstrated to be the probable cause of the observed thermal anomaly zone.

40668 (EUR—7578-DE) Seismic studies for the determination of the crustal structure in the region of geothermal anomaly in Tuscany. Giese, P.; Wigger, P.; Morelli, C.; Nicolich, R. (Freie Univ. Berlin (Germany, F.R.). Inst. fuer Geophysikalische Wissenschaften; Trieste Univ. (Italy). Ist. di Miniera e di Geofisica Applicata). 1981. 108p. (In German and English). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

Within this project the crustal and upper mantle structure in the region of the strongest continental European geothermal anomaly - the western parts of Tuscany and adjacent areas - have been investigated by seismic and mgnetotelluric methods. From the geothermal point of view the following questions were studied: seismic velocities as well as the electrical resistivity decrease at increasing temperatures. Accordingly this program comprises two parts: the study of the seismic velocity distribution and the study of the electrical resistivity distribution.

40669 (PB—82-105628) Geothermal effluent sampling workshop. Final report. (Denver Research Inst., CO (USA)). Jul 1981. 60p. NTIS, PC A04/MF A01.

This report outlines the major recommendations resulting from a workshop to identify gaps in existing geothermal effluent sampling methodologies, define needed research to fill those gaps, and recommend strategies to lead to a standardized sampling methodology.

40670 Preliminary guidelines for heat-flow-density determination. Balling, N.; Haenel, R.; Ungemach, P.; Vasseur, G.; Wheildon, J. Luxembourg; Commission of the European Communities (1981). 34p. (EUR—7360-EN). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Recommendations are given for heat flow density determination from shallow boreholes. The following are included: a procedure for topographic correction, a procedure for paleoclimatic correction, computer programs, and presentation of heat flow density data.

1505 Economic And Financial Aspects

REFER ALSO TO CITATION(S) 40674

1506 Environmental Aspects And Waste Disposal

40671 (USGS-OFR—80-1060) Continued seismic monitoring of the Geysers, California geothermal area. Ludwin, R.S.; Bufe, C.G. (Geological Survey, Washington, DC (USA)). 1980. 53p. Dept. of the Interior, Geological Survey, Washington, DC.

Portions of document are illegible.

Probable effects of geothermal development on seismicity at the Geysers are shown by the spatial coherence of decreases in gravity and pressure with maximum geodetic deformation and seismic moment sum along a line through the most developed area of the geothermal field. Increases in the mean number of events per day and in the magnitude of largest annual event correlate with increases in steam production. The two largest earthquakes in the steam field occurred near the two injection wells most distant from production wells, and large events ($M/sub\ c \geq 2.5$) occurred most frequently during months of peak injection. Spatial seismic clusters in proximity to injection wells have occurred soon after injection began. Preliminary data also indicate an increase in seismicity in a previously aseismic area near plant 15 following the beginning of power production at that plant in 1979.

1509 Geothermal Engineering

40672 (EUR—7062-EN) Feasibility of the connection of wells in hot dry rocks by means of hydraulic fracturing techniques: experimental research dealing with three-dimensional crack interaction, largely utilizing photoelastic techniques. Camponuovo, G.F.; Riccioni, R. (Instituto Sperimentale Modelli e Structure, Bergamo (Italy)). 1981. 126p. (In English and Italian). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Portions of document are illegible.

The feasibility of a heat-exchanger in Hot Dry Rocks (Commission of European Communities Project) has been analyzed by experimental and numerical tests of propagation and interaction of pressurized 3D cracks in elastic medium. After visualization of front evolution in transparent models, the fracture mechanics parameters in different configurations at various stages of propagation were evaluated by 3D photoelasticity, holography and finite element techniques.

40673 (LBL—12348) Clay-mineral fabrics and chemistry in Salton Trough geothermal fields. Haar, S.V.; Wolgemuth, K.; Schatz, J. (Lawrence Berkeley Lab., CA (USA); Terra Tek, Inc., Salt Lake City, UT (USA)). Jul 1981. Contract W-7405-ENG-48. 28p. (CONF-8010260—1). NTIS, PC A03/MF A01. Order Number DE82008925.

From Annual Clay Minerals Society conference; Waco, TX, USA (5 Oct 1980).

Fluid production from, and hence the economic viability of, a geothermal field is related to the amount of clay minerals in the caprock and in the reservoir rocks. In both the East Mesa and Cerro Prieto fields in the Salton Trough of southern California, United States, and Baja California, Mexico, scanning electron micrography (SEM) has vividly documented the role of clay fabrics in deltaic quartz-sandstone reservoirs. For example, in East Mesa well 78-30 at 1630 m depth in a zone of quartz dissolution, the clay present in pores exhibits an irregular, crenulate, honeycomb fabric and has the following composition from energy dispersive x-ray analysis (EDAX): Si 61%, Al 25%, Fe 20%, Na 6%, K 2%, and Mg 1%. Platy clusters of clay (kaolinite) in Cerro Prieto well T-366 at 2522 m in a 300°C geothermal aquifer were analyzed as: Si 62%, Al 25%, Mg 6%, and Fe 1%. In other samples, illite takes the form of wispy fibers whose intertwined ends form bridges across pores. These clay fabrics appear to reduce permeability significantly by clogging the pore throats, even though dissolution porosity ranges from 25 to 35%. Nineteen wells have been studied to date.

1510 Direct Energy Utilization

REFER ALSO TO CITATION(S) 40651

40674 (DOE/ET/27167—T2) Blueprint for financing geothermal district heating in California. Grattan, J.P.; Hansen, D.P. (California State Dept. of Conservation, Sacramento (USA); Hansen (Derek) and Associates, Inc., San Francisco, CA (USA)). Mar 1981. Contract FG03-78ET27167. 90p. NTIS, PC A05/MF A01. Order Number DE82008335.

The current legal and investment climate surrounding geothermal development is depicted. Changes that would make the climate more favorable to direct heat geothermal development are recommended. The Boise, Susanville, and Brady Hot Springs projects are analyzed. (MHR)

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 40673

40675 (EUR—7579-FR) Theoretical and experimental study of phase-change phenomena during self-vaporization in porous media. Final report. Podaire, A.; Bories, S. (Centre National de la Recherche Scientifique, 31 - Toulouse (France)). 1981. 130p. (In French). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The results presented concern the fundamental study of a phase change during a self-vaporizing process of liquid water in an homogeneous, isotropic and undeformable porous media. Experimental and numerical simulations have been performed for a simple case in which the heat and mass transfer are monodirectional. The local equations describing the phenomena have been resolved by using a finite elements method. The results obtained concern the evolution in space and time of thermodynamic variables: temperature, enthalpy, pressure, and of the liquid saturation. They have been tested by comparison with experimental results and a systematic study has been developed in order to appreciate the influence of different parameters: heat capacity, porosity, relative permeabilities.

17 WIND ENERGY

REFER ALSO TO CITATION(S) 40922

1701 Availability (climatology)

40676 (PB—81-142754) High yield wind energy resources in New York State. Final report, May 1979-May 1980. Sforza, P.M. (Flowpower, Inc., Huntington Station, NY (USA)). Jun 1980. 177p. NTIS, PC A09/MF A01.

This report details a wind energy inventory for New York State. The inventory is based on data collected at numerous meteorlogical stations and anemometers throughout the state. The data indicates there are a number of regions in the state which could possibly host one or more large (greater than 100 kW) wind turbine generators. The report also contains an extensive analysis of life cycle electrical energy production costs of various wind turbine generators which are now being manufactured or which will be manufactured in the near future.

40677 (PB—81-199937) Wind energy in Maryland. Tompkins, D. (Tompkins (Daryl), Friendly, MD (USA)). Jul 1980. 37p. NTIS, PC A03/MF A01.

This report marks one of the first steps in defining the wind energy option in Maryland. In the following sections the state-of-the-art is reviewed, applications, economic, and environmental issues were introduced, the results of a preliminary wind energy resource assessment completed in April of 1979 are discussed, and recommendations are made for further resource definition.

1704 Economics

40678 (SSEC/SP—31164) Wind-energy-conversion system analysis. Smith, L. (Southern Solar Energy Center Planning Project, Atlanta, GA (USA); South Carolina Electric and Gas Co., Columbia (USA)). Oct 1980. Contract AC02-79CS30166. 6p. NTIS, PC A02/MF A01. Order Number DE82009092.

A life cycle cost analysis of a 2 kW wind energy conversion machine for Charleston, South Carolina is presented. The total cost of the machine minus tax credits are analyzed, including operation and maintenance. A total cost per year is finally produced and a summation of total costs is presented. Sample outputs are given at a 15% discount rate and compared to outputs at a 10% discount rate. It is observed that even in the first year of the analysis there is a savings with the wind energy conversion system. A copy of the analysis form used as a basis to compute all the information given is enclosed. (LEW)

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 40385, 40914

40679 (DOE/ET/20242—78/1) Guidelines for siting WECS relative to small-scale terrain features. Final report. Frost, W.; Shieh, C.F. (FWG Associates, Inc., Tullahoma, TN (USA)). Dec 1981. Contract AC06-76ET20242. 215p. (PNL—2145). NTIS, PC A10/MF A01. Order Number DE82009124.

Because real terrain is too complex and random to allow development of quantitative site selection data for specific applications, guidelines for siting wind energy conversion systems (WECS) relative to small-scale terrain features have been extracted from literature relative to analytical and experimental studies of fluid flow over geometries which represent idealized terrain features. These guidelines are presented in a format suitable for assessing the influence of small or microscale terrain features on a proposed wind turbine site. In organizing the available information, three categories of terrain were considered: (1) protrusions, topographical features that protrude well above the general level of their neighboring terrain; (2) depressions, areas such as valleys, canyons, or passes; and (3) complex terrain, so rugged or irregular that no well-defined protrusion or depression can be easily distinguished. The optimum site on a protrusion is always at the highest point. The smoother the peak of the protrusion and the more gentle the slopes on all sides the more optimum the site, providing the geometry and orientation of the depression are such that full advantage can be taken of existing strong valley winds or outflow. Where the terrain is very complex and tortuous, the highest point of the topography will be the optimum site.

40680 (DOE/ET/20242—81/2) Analysis of a kite anemometer. Final report. Huang, K.H.; Shieh, C.F.; Frost, W. (FWG Associates, Inc., Tullahoma, TN (USA)). Dec 1981. Contract AC06-76ET20242. 62p. NTIS, PC A04/MF A01. Order Number DE82009058.

Equations of motion for a rigid, tailless kite and tether system are derived from free body diagrams. A direct, analytical solution of these equations provides tether tension in a steady wind. Numerical solutions of linearized equations of motion provide the kite tether tension in a transient, turbulent wind field. A similar analysis is applied to a kite-tail-tether system. The results of these analyses show that line tension at the ground anchor is within a few percent of tether tension at the kite. Wind shear does not significantly affect line tension. Thus the tethered kite anemometer can measure height-dependent wind fields based on steady-state, uniform wind calibrations. Unsteady winds also have an insignificant effect on the tether if gust amplitude and frequency are such that tether accelerations are below $9.8 m/s^2$. In a variable wind, tether tension is in phase with wind variations. Tension amplitude is dependent on the magnitude and frequency of wind variations.

40681 **(FFA-TN-HU—2218) Study of wind energy conversion systems (WECS) in a farm area and WECS safety limit requirements. Minutes from Expert Meeting, IEA, Research and Development WECS, Annex One, Subtask A1.** Eggwertz, S. (Flygtekniska Foersoeksanstalten, Stockholm (Sweden). Structures Dept.). 1980. 114p. NTIS, PC A06/MF A01.

The proceedings include the description of two 2500 kW windmill prototypes, safety studies performed in several countries, and a contribution concerning fault tree analysis and load case recommendations. The introduction of safe zone, the crack detection system, and operation during icing conditions are discussed.

40682 **(PB—81-140675) Aerodynamic characteristics of the TARP (Toroidal Accelerator Rotor Platform) wind energy conversion system. Final report, 1978-1979.** Duffy, R.E.; Jaran, C.; Ungermann, C. (Rensselaer Polytechnic Inst., Troy, NY (USA)). Feb 1980. 72p. NTIS, PC A04/MF A01.

Augmented wind energy conversion systems are designed to increase the ambient wind velocity at the turbine blades. The Toroidal Accelerator Rotor Platform (TARP) is an innovative, augmenting structure for use with horizontal axis WECS. Its shape resembles that of a horizontally-oriented wheel rim and is intended to be built into or retrofitted onto structures built for other purposes, which could increase the use of WECS in urban areas. This report details how variations of the basic TARP structure, about three feet in diameter, were tested in a wind tunnel to determine the optimum design. The model system produced up to 4.5 times the power which the rotor and generator extracted without the TARP.

40683 **(PB—81-141467) Lebost wind turbine experimental program. Report for September 1978-May 1980.** Miller, G.; Hoffert, M.; Rugg, B.; Corren, D. (New York Univ., NY (USA). Dept. of Applied Science). May 1980. 55p. NTIS, PC A04/MF A01.

The Lebost Wind Turbine is unique in two respects: it consists of a vertical axis turbine which is encased in a perforated hemispherical shroud which acts to focus or concentrate ambient wind energy onto the turbine blades; and the turbine's shaft is directly coupled to a water twister/heat brake assembly which heats water via direct mechanical agitation; in other words, the turbine can be used to heat water without electrical interface. This report details the results of an experimental field test/evaluation of a 20-foot diameter Lebost turbine. One conclusion of the study is that the turbine lends itself rather well to urban applications, as well as other applications.

40684 **(PB—81-142184) Velocity induced by the wake of a wind turbine in a shear layer, including ground effect. Report FFA-133.** Johansson, B.C.A. (Flygtekniska Foersoeksanstalten, Stockholm (Sweden)). Jun 1980. 43p. NTIS, PC A03/MF A01.

A theory is developed for the calculation of the velocity field induced by the wake of a horizontal axis wind turbine in a wind shear layer and in the vicinity of a plane ground surface, when the force distribution of the turbine is known. The turbine is approximated by a disk area of continuous distributions of thrust and force parallel to the disk plane. Its wake is represented by a semi-infinite cylinder of distributed vorticity. A numerical example is calculated. The theory is based upon assumptions strictly valid only for small perturbations of the undisturbed flow. However, the results may have a wider range of applicability.

40685 **Field control for wind-driven generators.** Soderholm, L.H.; Andrew, J.F. US Patent Application 193,877. 3 Oct 1980. 12p.

The field current of a wind-driven generator is automatically controlled in response to a first signal representing the wind speed and a second signal representing the impeller tip speed so as to continuously load the wind machine to the extent necessary for maintaining a constant tip speed/wind speed ratio, thereby optimizing the performance of the machine.

40686 **Wind power project. Progress report 2.** Aarhus, Denmark; Jydsk Telefon (1980). 65p. (In Danish).

The purpose of the project was to establish whether a windpower plant can be used as a primary power source for telephone rural district centrals. Windpower plants can be used as emergency power supply in case of any failure in the common power networks. New control- and regulation systems had to be tested in an experimental windmill in Nees at Nissum Fjord. The average wind velocity was about 3.4 m/sec, electric power produced 4.626 kWh. Hysteresis brakes used as a speed regulator are proved to be a new very efficient component of windmill control. Results achieved after 1 year prove net-unconnected windpower plants to be the right solution for uncritical loads (f.in. heat load) in telestation feeding.

20 ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 40726

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 40822, 40903, 40904, 40909, 40911, 41018

40687 **(AD-A—097870/0) Civil Engineering Laboratory Cogeneration Analysis program - CELCAP user documentation. Contract report March-September 1980.** Bradlord, P. (Two D Engineering, Inc., Oxnard, CA (USA)). Mar 1981. 119p. NTIS PC MF A01.

This report documents input requirements for the CEL Cogeneration Analysis Program (CELCAP) and includes reference material from which much of the input data can be drawn. A sample of each card is provided. No program listing or output listing is included, however. CELCAP analyzes the performance and economics of cogeneration systems utilizing combustion turbines, diesels, or steam turbines. The effects of engine combinations, engine size, control mode, use of peaking engines, utility rate structure, sale of power to the utility grid, fuel type, fuel price, and future cost escalations can be determined by varying the input. The program computes design point engine performance, compares thermal and electrical loads against engine output, adjusts engine output according to the assumed control mode, and calculates the resulting instantaneous and life cycle costs of operation. The program is written in FORTRAN IV for execution on CDC system with 60 bit words.

40688 (CONF-811061—, pp 6-26) **Materials for coal gasification combined cycle power plants.** Bakker, W.T.; Stringer, J. (Electric Power Research Inst., Palo Alto, CA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Coal gasification and power generation are closely integrated in a Coal Gasification Combined Cycle (CGCC) power plant. Thus, maximum efficiency is combined with the potential for greatly reduced sulfur emissions. First generation designs strive to minimize materials problems, by avoiding the exposure of metallic components to corrosive reducing gases at high temperatures. Future improvements in efficiency may be obtained through the use of higher heat exchanger and turbine inlet temperatures, provided the plant reliability is not reduced.

40689 (CONF-811061—, pp 29) **CEGB coal combustion materials research and development program.** Holmes, D.R. (Central Electricity Research Labs., Leatherhead, England). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The CEGB burns 80 MM tons of coal per year in 82 power stations, more than 98% of it as pulverized fuel. With this scale of operation significant materials problems arise and there is great scope for reducing costs by increasing efficiency and availability. The main problems currently causing loss of availability are superheater and furnace wall tube corrosion, generally associated with unsatisfactory fuel/air mixing in the combustion chamber, with flame impingement and with the combustion of high chloride coals (>3.0 w/o). Significant operational problems and costs also occur

with coal handling and grinding equipment and with back end (dew-point) corrosion. The research programmes in hand to deal with some of these problems are briefly discussed and the early significant results from them described. Current CEGB materials research to improve the efficiency of existing plant are described, together with exploratory assessment work on possibilities for high efficiency future plant.

40690 (CONF-811061—, pp II.25) **Corrosion related failures in power plant feedwater heaters.** Agrawal, A.K.; Beavers, J.A. (Battelle-Columbus Labs., OH). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The objectives of this study are to provide an independent analysis of data related to the operation, maintenance, retrofitting and design of feedwater heaters in order to minimize corrosion related failures. A literature search is being conducted on feedwater heater performance in both nuclear and fossil power plants covering the following: (i) a review of workshops and studies such as the EPRI Feedwater Heater Workshops; (ii) computer searches including DOE Recon, MCIC, CDA and Chemical Abstracts data files; (iii) hand searches of pertinent abstracts not in computer data files, such as Corrosion Abstracts; and (iv) telephone and letter requests for data from vendors and utilities, both domestic and foreign.

40691 (CONF-811061—, pp III.116-III.127) **Protection of ID fans from erosion damage.** Sverdrup, E.F.; Chamberlain, R.M. (Westinghouse Research Labs., Pittsburgh, PA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The objective of this program was to understand how to control erosion damage in coal-fired power plant fans. The program involved five tasks: quantifying the cost to electric utilities of fly ash erosion damage in coal-fired plants currently operating; using particle trajectory and erosion damage prediction computer programs to evaluate the relative tolerance of various fan designs to fly ash in order to allow a quantitative assessment of erosion among the many trade-offs involved in the selection of power plant fans; understanding the range of erosivities of fly ash that a utility might encounter with the ultimate objective of enabling a prediction of erosion severity from core borings of the fuel to be fired; evaluatig the costs and benefits of developing erosion armoring systems specifically designed to be easily replaceable in the field; and to define the characteristics of a superior fly-ash armoring system to indicate promising avenues for development. Control of fly-ash erosion in coal-fired power plants can be achieved through: proper fan selection (Computer calculations of fan erosion rates can quantify selection trade-offs); adopting operating procedures that control the quantity and size of the fly ash bombarding the fan. (Maintaining high precipitator efficiencies; preventing reentrainment); armored fans can ease maintenance requirements and keep fans on line (Chrome plating can more than double part life. Advanced, erosion-resistant coatings can give up to 16 times the life of 0.25 in. of mild steel). Although the cost of these armoring systems is high so is the cost of the downtime they save.

40692 (CONF-811061—, pp V.37-V.43) **Gas turbine cascade for the IEA PFB at Grimethorpe.** McCarron, R.L. (General Electric Co., Schenectady, NY). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The objective of this program is to evaluate the nature and extent of corrosion, erosion, and deposition on a variety of candidate gas turbine vane and blade materials exposed to the effluent from the IEA pressurized fluidized bed combustor test facility located in Grimethorpe, England. This test offers the opportunity to examine the response of airfoil-shaped specimens dimensionally scaled to represent the first stage rotor blades of a General Electric MS 1000 industrial gas turbine. The results will provide the basis for selecting materials and protective coating systems for first generation gas turbines fired by PFB's. The cascade assembly test passage is a scaled-up version (10 lbm/sec) of the CURI cascade (1 lbm/sec). Hot gases entering the test passage flow through three cascades of impulse type airfoils (nine airfoils per cascade) followed by a single cascade of nine reaction airfoils, followed by three erosion specimens in the region of high velocity downstream of the reaction cascade. Four specimens out of the nine in each of the first and third impulse cascades will be air-cooled while five out of nine in the second cascade will be air cooled; the reaction specimens in the fourth cascade will be uncooled. One of the three erosion specimens located downstream of the fourth cascade will be air-cooled. The cooled specimens will run at 1200°F, approximately 360°F below the expected gas temperature at the metal surface of 1560°F. The selection of base materials, coatings and claddings is based on all information available to date on the erosion and corrosion behavior of materials in PFBC exhaust gases.

40693 (CONF-811061—, pp V.44-V.54) **Protective coatings for electric utility gas turbines.** Goebel, J.A. (United Technologies Corp., South Windsor, CT); Giggins, C.S.; Krasij, M.; Stringer, J. 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Sulfate-induced hot corrosion continues to be a major cause of turbine airfoil deterioration for industrial and utility gas turbines. Moreover, hot corrosion can be expected to be a continuing problem even for engines operating on relatively pure distillate fuels. Significant increases in turbine reliability have been achieved in recent years through the use of more corrosion resistant superalloys, such as IN792; or airfoil coatings, such as 20-12 CoCrAlY. Further improvements in airfoil durability are believed possible, and United Technologies has been engaged in a program to develop more resistant coatings under the sponsorship of the Electric Power Research Institute. The objective of this program is to develop coatings for utility gas turbines which will improve the durability of the present generation of industrial gas turbines, thereby increasing on-line availability and subsequently reducing maintenance costs. In addition, it is hoped that the planned program will develop methodologies and techniques which will improve the efficiency and durability of next generation industrial gas turbines by allowing the turbine hot section airfoils to achieve longer lifetimes while utilizing fuels with higher contamination level and/or while operating at higher temperatures.

40694 (CONF-811061—, pp V.55-V.63) **Corrosion fatigue of 174 PH turbine blade steel in chloride environments.** Viswanathan, R.; Syrett, B.C. (Electric Power Research Inst., Palo Alto, CA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The results of different heat treatments and surface shot peening treatments on the fatigue life of this steel exposed to 6% iron chloride solution are reported. A considerable drop in fatigue life (S-N) curves was shown for all the materials exposed to the chloride compassed to testing in air. (LTN)

40695 (CONF-811061—, pp V.64-V.79) **Advanced technology high temperature CrMoV steam turbine rotors.** Swaminathan, V.P. (Westinghouse Electric Corp., Philadelphia, PA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

From the results obtained thus far it can be concluded that the mechanical properties of the advanced technology rotor forgings are equal to or better than those of conventional rotors. Superiority is evident especially where the sulfur content is influential, namely, ductility, charpy energy, rupture ductility and fracture toughness. In the low S rotor the segregate bands observed on the top end were virtually free from sulfur. Metallic segregation by itself does not seem to affect the propertes as evidenced in this investigation. The properties obtained from the segregated top test end showed little difference from those of the bottom end containing no segregation bands. Further work is in progress to investigate the effects of the inclusion free segregate bands on the low cycle fatigue properties as well as characterization of these segregates with respect to microstructure and chemistry variations.

40696 (CONF-811061—, pp V.80-V.91) **Coating technology for the prevention of aqueous corrosion in low pressure steam turbines.** Kramer, L.D.; Kratz, J.L. (Westinghouse Electric Corp., Lester, PA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Corrosion induced failures of low-pressure steam turbine components are an important cause of forced outages. One potential solution is the use of protective coatings applied to low-pressure blading and mating rotor grooves. These coatings are expected either to isolate the metal substrates from the steam transported corrodents by forming an inert surface barrier or to modify the electrochemical characteristics of the substrate, e.g., by providing cathodic protection. Existing coating schemes are identified for evaluation in laboratory tests and the most successful of these are then evaluated field exposure tests. The objective is to identify one or more commercially available coating systems that will successfully eliminate or reduce the deleterious effects of hostile environments on turbine blade and rotor steeple material substrates under vibrational loading. The barrier type coatings when exposed to 20 KHz fatigue testing showed a great deal more variability than observed in the previous cases. The best material in fatigue was the silicon diamine organic coating with an endurance limit of 49 KSI. The chromate conversion coating and the teflon powder coating both had endurance limits of 48 KSI. These are the only materials which approximated the scatter band of the uncoated 403 SS substrate. Significant drops in fatigue strength were observed for both the nickel-chromium plasma spray and the chemically vapor deposited nickel coatings but the electron beam deposited zirconium and the two pack cementation boride coatings had the worst fatigue strength observed for any barrier coatings.

40697 (CONF-811061—, pp VI.41-VI.51) **Titanium L-1 blade retrofit in Commonwealth Edison Kincaid Station.** Rust, T.M.; Thomas, J.P. (Westinghouse Electric Corp., Philadelphia, PA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Corrosion and corrosion related failures of steam turbine blading are a significant problem in the power industry. Blade problems are the single largest cause of forced outage in steam turbines. A substantial number of these failures are corrosion caused. Chloride and other contaminants in turbine steam can cause corrosion, stress corrosion and corrosion fatigue in blading steel. These chemical corrodents enter the steam cycle through improper water treatment, condenser leaks, defective demineralizers or improper cleaning techniques. Although initially present in very small concentrations (ppB), the corrodents build up to corrosively significant concentrations through constant deposition in certain areas of the turbine. This corrosion problem is especially acute in the transition stage of the low pressure turbine, where moisture first begins to form as steam expands through the turbine. In these regions chloride concentrations as high as 28% can be produced from very low levels of steam contaminants. In such concentrated solutions, chloride can easily produce failure in steel blade alloys. The excellent corrosion resistance of titanium and its good structural properties make it an excellent candidate for corrosion resistant steam turbine blading. To explore this further, Westinghouse, the Electric Power Research Institute and Commonwealth Edison are participating in a joint project to apply titanium blades in corrosion-prone turbines. The blade chosen is a transition stage, 16 inch, tapered, twisted reaction blade found typically in 300 and 600 megawatt size fossil fueled steam turbines. The material selected was the Ti-6Al-4V alloy. This alloy shows a good combination of mechanical properties, is readily available in comparison to other titanium alloys, and enjoys a substantial technical knowledge base.

40698 (CONF-811061—, pp VI.61-VI.68) **Protective claddings for utility gas turbines.** Beltran, A.M.; Farrell, T.R.; Ostergren, W.J.; Russell, E.S.; Schilling, W.F.; Wlodek, S.T.; Wood, J.H. (General Electric Co., Schenectady, NY). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The overall objective of this program is to develop superior gas turbine bucket hardware by protecting those buckets with claddings. More specifically, the goal is to develop a process for cladding utility-size gas turbine buckets, thereby providing improved corrosion resistance at a cost that is comparable to presently available coatings. Equally important is a comprehensive mechanical test program aimed at determining the effect of the claddings on the mechanical properties of the clad composite. To accomplish these objectives, the program was divided into the following two major technical tasks: process development and clad bucket fabrication and mechanics of the cladding materials and the composites.

40699 (CONF-811061—, pp VI.69-VI.84) **Low cost electroslag cast materials and components for application in fossil energy systems: the status of manufacturing technology.** Bhat, G.K. (Carnegie-Mellon Univ., Pittsburgh, PA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Manufacturing technology for improved low-cost electroslag cast materials and components for application in fossil energy systems has been developed. An industrial scale electroslag casting facility has been established and this equipment and process technology is now available for the manufacture of electroslag castings of diverse solid and hollow shapes and weight up to 2 tons. Economic and technical merits of this process appear to provide the necessary incentives for future growth of the electroslag casting technology. The electroslag casting process has features common to electroslag remelting. A consumable electrode is remelted under a layer of molten slag to form a metal pool which is progressively solidified in a water cooled mold. The electrical power applied through the electrode to the slag layer is converted by Joule heating into thermal energy. The solidification of the metal is accomplished under a layer of protective slag in water cooled molds. A solidified slag skin envelopes the casting like an egg-shell and promotes development of a smooth surface on the casting. Axial or other cavities in the cast component are formed through the use of water cooled mandrels or solid cores within the mold during the casting operation. Thus, the electroslag casting process (ESC) neatly integrates into one system the diverse processing sequences of melting, refining and solidification of the desired alloy metal melted in a precisely controlled manner for the one step production of near final shape, high-integrity, cast components.

40700 (DOE/FE—0018) **Potential for increased use of anthracite by electric utilities: implications of the exemption from the EPA new source performance standards for power plants.** (Berger Associates, Harrisburg, PA (USA)). Feb 1982. Contract AC01-79RA20005. 74p. NTIS, PC A04/MF A01. Order Number DE82008771.

The prospect for expanded utility use of anthracite by the year 2000 appears promising. It has been generally considered that anthracite can meet the ambient SO_2 standard of 1.2 lbs. SO_2 per million Btu without the use of scrubbers. In that event, the results of the engineering economic analysis show that an anthracite-based electric generating unit can be competitive with a comparable bituminous coal-fired unit. The logical competitive utility market area for anthracite is the Northeastern United States and the Middle Atlantic States because of the proximity of these areas to the anthracite region. Transport costs would be lower for anthracite (versus western Pennsylvania bituminous coal) to destinations in the areas of states immediately north, east and southeast of the eastern Pennsylvania anthracite region - upstate New York, New Jersey and Delaware, in particular. The analyses of the impact of the New Source Performance Standards (NSPS) exemption, and of future base load plant expansions, indicates that the potential additional utility use of anthracite over the next two decades is within a range of 1.5 to 15 million tons per year. One means of enhancing the competitive posture of anthracite versus bituminous, the analysis concludes, could be a more intense examination of anthracite resources to determine the best locations of large quantities of low sulfur recoverable reserves. Similarly, a more detailed investigation of a stockpile program would be warranted to determine its feasibility as a means of providing reserve potential, primarily during initial expansion, to allay supply reliability concerns.

40701 **(DTH-LET-RE—80-10) Optimization of a power plant process. A practical method to determine the rest of operational life cycle and process improvement.** Meisingset, L. (Danmarks Tekniske Hojskole, Lyngby. Lab. for Energiteknik). Feb 1980. 69p. (In Danish). Risoe Library, DK-4000 Roskilde, Denmark.

An attempt was made to find methods and practical solutions to improve operational parameters of existing and future power plants. By optimization of process parameters better efficiency, decreased environmental pollution and more careful use of the critial system-components are achieved. Analysis of the methods used for lifetime estimation proved, that a modified version of Palmgren and Miner linear damage hypothesis can be recommended for power plant components with changing load. Other more precise methods require symmetric load cycles or detailed knowledge of stress/strain ratio. Examples of thermal process surveillance and improvements of operation, as well as data collection and service-time estimation are given from a turbine rotor in North-Zealand (Denmark).

40702 **(EUR—7088-DE) Stationary flywheel energy storage.** Gilhaus, A.; Hau, E.; Gassner, G.; Huss, G.; Schauberger, H. (Maschinenfabrik Augsburg-Nuernberg (M.A.N.) A.G., Muenchen (Germany, F.R.)). 1981. 162p. (In German). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The aim of this system study is to find out industrial applications of stationary flywheel energy accumulators. The economic value for the consumer and the effects on the power supply grid are investigated. Up to now, stationary flywheel energy accumulators have only been used in a small range. The main reason for thinking of the application in a wider range was the hope that those could be used economically for lowering the maximum output demand of the power supply grid. The possible savings in energy costs, however, proved to be too small for paying back the investment costs. Further benefits are necessary for advantageous application. As to overall economy, compensation of short time maximum power output seems to be more favorable at the power stations. An additional possibility for energy storage by flywheels is given where otherwise lost energy can be used effectively, according to the successful brake energy storage in vehicles. Under this aspect the future use of flywheels in wind-power-plants seems to be promising. Attractive savings of energy can be obtained by introducing modern flywheel technology for emergency power supply units which are employed for instance in telecommunication systems. Especially the application for emergency power supply, in power stations and in combustion with wind energy converters need further investigation.

40703 **(EUR—7529-DE) Evaluation of attainable efficiencies and costs for generation of electricity from hydrogen.** Sternfeld, H.J.; Wojkowsky, H.; Schnurnberger, W.; Sternfeld, H.J. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Lampoldshausen (Germany, F.R.). Inst. fuer Chemische Antriebe und Verfahrenstechnik; Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Stuttgart (Germany, F.R.). Inst. fuer Technische Physik). 1981. 235p. (In German). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

For the genertion of electricity from stored hydrogen, H_2/O_2- and H_2/air fuel cells as well as gasturbine and steamturbine cycles can be applied within a measurable space of time. In this study alternative methods are technically and economically evaluated. All important parameters affecting the energy conversion efficiencies are taken into account. Power levels of 25, 50 and 100 megawatts, which are preferably used for peak-power plants, are considered for annual operating times between 500 and 3000 hours. The highest overall efficiencies of more than 50% are offered by the H_2/O_2-steamturbine process and the H_2/O_2-fuel cell, while a simple gasturbine power plant yields close to 30%, the lowest value found. The costs of electricity are decreasing with increasing power level and annual operating time. The lowest values are found for a 100 MW-hydrogen/oxygen steamturbine power plant; while for the 25 MW-power level and a very short annual operating time, the H_2/O_2-fuel cell system offers slightly lower cost values than the H_2/O_2-steamturbine plant. Peakpower electricity from hydrogen, however, could be produced at a cost level almost comparable with existing devices, when a fossil fired base-load power plant is equipped with a supplementary H_2/O_2-steamgenerator that complements the varying power demands.

40704 **(HEDL-TME—81-53) Steam-Electric Power-Plant-Cooling Handbook.** Sonnichsen, J.C.; Carlson, H.A.; Charles, P.D.; Jacobson, L.D.; Tadlock, L.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Feb 1982. Contract AC06-76FF02170. 193p. NTIS, PC A09/MF A01. Order Number DE82008597.

The Steam-Electric Power Plant Cooling Handbook provides summary data on steam-electric power plant capacity, generation and number of plants for each cooling means, by Electric Regions, Water Resource Regions and National Electric Reliability Council Areas. Water consumption by once-through cooling, cooling ponds and wet evaporative towers is discussed and a methodology for computation of water consumption is provided for a typical steam-electric plant which uses a wet evaporative tower or cooling pond for cooling.

40705 **(P—300-81-021) Technical assessment manual. Appendices second edition. Staff report.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). Sep 1981. 147p. California Energy Commission, 1111 Howe Ave., Sacramento, CA 95825.

Portions of document are illegible.

This set of appendices includes certain internal staff memoranda and working papers necessary for the review of technical descriptions contained in the Technical Assessments Manual. These memoranda and working papers have not been previously published and are provided to facilitate the review of the methods, reasoning and assumptions used in developing the nominal technology descriptions. The subjects covered include: modeling the make-up water requirements for power plant cooling towers; lead times for various power plant technologies; nuclear fuel cost and performance; costs of decommissioning light water reactors; capital cost estimations; capital cost escalation; and levelized cost calculation for power plants.

40706 **(PB—81-131997) Electric powerplant cancellations and delays. Report to the Congress.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 8 Dec 1980. 43p. NTIS, PC A03/MF A01.

From 1974 through 1978, the Nation's electric utilities cancelled plans for 184 electrical generating units and delayed construction on most other new units. Delays, particularly for nuclear plants, are getting longer each year. Lower rates of increases in electricity demand, utilities' financial difficulties, and regulatory complexities are the major reasons for cancellations and delays. Continued cancellations and delays may contribute to increased oil consumption, greater dependence on foreign oil, greater potential for electrical service interruptions, and higher electricity rates for consumers. This report pinpoints major problem areas needing the continuing attention of the Department of Energy, utilities and utility regulators.

40707 **(PB—81-141939) Chlorine minimization/optimization for condenser biofouling control. Final report. Report for December 1975-March 1980.** Moss, R.D.; Flora, H.B. II; Hiltunen, R.A.; Seaman, C.V.; Jones, J.W. (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Demonstrations and Technology). Aug 1980. 268p. NTIS, PC A12/MF A01.

The report summarizes results of a chlorine minimization/optimization study for the control of biofouling on the surface of condenser tubes at TVA's John Sevier Plant from December 1975 to December 1978.

40708 **(PB—81-150237) Desalination/power cycles with the biphase rotary separator and turbine. Final report.** Limburg, P.L. (Biphase Energy Systems, Santa Monica, CA (USA)). Sep 1980. 93p. NTIS, PC A05/MF A01.

The Biphase Rotary Separator Turbine (RST) generates fresh water and power when using salt water as a working fluid. Cycle studies of single- and two-stage RST cycles determined water-production rates to be 0.6 to 1.8 pounds per thousand Btus of heat input and net power-production efficiencies of 2 to 10 percent, depending on cycle configuration and the maximum saltwater temperature. The Biphase RST can be beneficially integrated with conventional desalination processes. Cycles studied include a topping cycle for distillation plants, shaft-power-source cycle for reverse osmosis and vapor-compression plants, and a reverse-osmosis cycle recovering the reject-brine pressure energy. Short duration tests of a Biphase RST showed that fresh water production (30 ppM TDS) from seawater is feasible. Conceptual design studies were made of a single-stage desalination/power system suitable for a first demonstration plant. The system produces 9000 gallons per day and 90 horsepower from the exhaust-gas energy of a 2125 horsepower diesel engine.

40709 **(PB—81-231474) Power plant cooling system water consumption and nonwater impact reports. Executive summary August 1979-April 1981.** Hu, M.C.; Pavlenco, G.F.; Englesson, G.A. (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Jul 1981. 70p. NTIS, PC A04/MF A01.

Water evaporation and consumption of power plant cooling systems were studied and six simple generic evaporation prediction models were evaluated, one for cooling towers and five for cooling ponds/lakes using field data provided by twelve utilities. Also evaluated in the study is a regional comparison of evaporation rates of cooling towers and cooling ponds/lakes with the objective of determining which of the two cooling system types is more water consumptive in terms of evaporation only.

40710 **(PB—81-853954) Computer analysis applied to energy conversion efficiency. January 1972-November 1980 (citations from the International Aerospace Abstracts Data Base). Report for January 1972-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 232p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning computerized simultaion, computer-aided design, and computer programs for theoretical, experimental, and operational considerations of energy conversion efficiency from a wide variety of energy sources, systems, devices, and energy conversion techniques. Solar technology is emphasized. (Contains 222 citations, fully indexed and including a table of contents.)

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 40148, 40867, 41355, 41432, 41453

40711 (CONF-811061—, pp II.19-II.24) **Corrosion/erosion laboratory and field testing.** Koch, G.H.; Beavers, J.A. (Battelle-Columbus Labs., OH). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

At a chloride concentration of 200 ppM, all alloys were resistant to uniform and localized attack. However, at chloride concentration of 5000 ppM, the 300 series stainless steels showed considerable pitting and crevice corrosion. Also, some of these alloys suffered high uniform corrosion rates. The austenitic stainless steel 904L showed severe pitting and crevice corrosion, while the duplex stainless steel Ferralium also suffered considerable pitting/crevice corrosion and intergranular corrosion. The nickel-base alloys Hastelloy C-276, Inconel 625, Hastelloy G and the iron base alloy A16X appeared to be resistant to localized and uniform attack. Both the commercial pure Titanium (Grade 2) and Ti Code 12 were highly resistant to the simulated duct environments. A significant observation was the high resistance to pitting and uniform corrosion of the ferritic stainless steel Monit. However, crevice and intergranular corrosion in the weld was observed. Another alternative to solid nickel or titanium alloys is cladding, where a thin sheet of a corrosion resistant material is bonded to a carbon steel substrate. A clad material, Inconel 625 roll bonded on carbon steel and containing a weld, was evaluated. No evidence of corrosion in or adjacent to the weld was found. Carbon steel lined with organic or inorganic materials is another alternative to the more expensive alloys. Generally, the linings investigated were resistant to the wet acidic environments even at chloride contents of 5000 ppM. However, the linings could not withstand the temperature changes to 120°C and either deteriorated or delaminated from the carbon steel substrate. The low resistance to temperature upsets was a major shortcoming of these linings.

40712 **(DOE/MC/16229—T2) Configurational testing of electron beam ionization for coal fly ash precipitators. Quarterly report No. 2, March 2, 1981-June 1, 1981.** Davis, R.H. (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1981. Contract AC21-81MC16229. 27p. NTIS, PC A03/MF A01. Order Number DE82009517.

Machine shop drawings for the electrostatic precipitator test system were completed and bid specifications were prepared during this quarter. The ordering of digital equipment for the microcomputer data handling system was essentially completed and the subsystems were tested as they were delivered by connecting them to a similar system housed in the Physics Department. The optical monitor system was delivered. The performance-effectiveness and cost-effectiveness of fluidized bed aerosol generation as a solution to the heavy dust load problem were assessed and a number of questions arised for subsequent investigation. Dr. Okihiro Tokunaga of the Japan Atomic Energy Research Institute arrived early during this quarter and gave a number of seminars on electron beam treatment of stack gas for the removal of SO_2 and NO/sub x/ . Experiments were carried out to confirm the stability of the large ion current produced by secondary ionization while driving the test volume to the maximum current which existing power supplies can provide. Three analyses are summarized here: comparison of the field emission field limit for the charge on a particle with that calculated in the Mark I precharger model; transmission curves for electron beams at selected energies; and power vs. current from previous experiments.

40713 **(PB—81-162505) Flue gas desulfurization information system (FGDIS) data base user's manual.** Smith, M. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Mar 1981. 127p. NTIS PC A07/MF A01.

This manual is intended to provide a guide to the use of the Flue Gas Desulfurization Information System (FGDIS) data base which is a collection of data files consisting of information pertaining to the design and performance of flue gas desulfurization (FGD) systems. The files are stored at the U.S. Environmental Protection Agency National Computer Center (NCC), Research Triangle Park, NC. Access to these files and manipulation of the data therein is accomplished via System 2000, general data base management system developed by INTEL Corp. and supported by the NCC Univac 1100 hardware.

40714 **(PB—81-191116) Selective catalytic reduction and NOx control in Japan. Final report, March 1980-January 1981.** Jones, G.D. (Radian Corp., Austin, TX (USA)). Mar 1981. 269p. (RAD—81-203-001-27-07). NTIS PC A12/MF A01.

The report documents the travels of a four-member study team in Japan during March 1980 to assess NOx flue gas treatment (FGT) technology and related areas. Overall goals of the study were to obtain new information on current issues concerning application of FGT technology and to update information previously published. A total of 28 equipment vendors, process operators, government agencies, and industry groups were contacted. Substantial recent progress was discovered with regard to commercial applications of selective catalytic reduction (SCR) technology to gas- and oil-fired boilers. There are several applications where SCR systems are operated continuously and are successfully removing 80% of the NOx from the flue gas stream. Current development and demonstration efforts are aimed at applying SCR technology to coal-

fired boilers since that fraction of Japan's total electric power generation is expected to increase to 12.5% in 1995 and since most of the new coal-fired boilers will use FGT technology for NOx control. Since four SCR systems on coal-fired boilers are scheduled to start up in 1980 and 1981, the Japanese activity in the NOx control field should be of considerable interest in the U.S. for at least the next 4 years.

40715 **(PB—81-206476) Technical review of dry FGD systems and economic evaluation of spray dryer FGD systems. Final report May 79-Nov 80.** Burnett, T.A.; Anderson, K.D. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Div. of Energy Demonstrations and Technology). Feb 1981. 279p. NTIS, PC A13/MF A01.

The report gives results of an extensive study of dry flue gas desulfurization (FGD) systems, involving dry injection of absorbents or spray drying. (The study was undertaken because they appear to have both process and economic advantages over wet FGD.) Design concepts (e.g., type of absorbent and atomizer, approach to flue gas saturation temperature, and particulate collection method) remain to be demonstrated at full scale. Most vendors prefer a lime slurry system with rotary atomizers and fabric filter particulate collection, while all systems now under contract to utilities apply to low-sulfur coal. SO_2 removal efficiencies sufficient for high-sulfur coal applications at stable operating conditions and economically feasible absorbent utilization rates have not yet been demonstrated. In conceptual design cost comparisons based on a new 500-MW utility power generation unit, a lime spray dryer/fabric filter combination had lower capital investments and annual revenue requirements for 0.7% sulfur western coal and both 0.7 and 3.5% sulfur eastern coal than a wet limestone scrubbing process. With lignite fuel, similar cost advantages were evident for dry (relative to wet) FGD. The capital investment advantage of dry over wet FGD increased with increasing coal sulfur content.

40716 **(PB—82-105370) Mobilization of heavy metals from fossil-fuelled power plants, potential ecological and biochemical implications. Part II: definition of the problem using a critical path approach, motivation, objectives and research programme to study the European situation.** Goetz, L.; Sabbioni, E. (Commission of the European Communities, Luxembourg). [nd]. 25p. NTIS PC E01/MF E01.

The critical path approach to heavy metals (HM) released from fossil-fuelled power plants (FFPP) into the environment takes account of: (1) emission into the atmosphere; (2) ash pond-water discharge; (3) other waste water discharges; (4) coal pile run-off; (5) disposal of fly-ash and bottom ash. Direct impact on the FFPP area and indirect impact at a distance are distinguished, and atmospheric, hydrological and terrestrial dispersion models are proposed. An ecological effects model is needed to assess the bioenvironmental effects. The final objective is to set limits to the emission of HM into the environment.

2003 Power Transmission And Distribution

40717 **(CONF-820331—1) Application of short-term biotests to health risk analysis of fluorinated compounds.** Dudney, C.S.; Walsh, P.J.; Owen, B.A. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE82008840.

From 3. conference on gaseous dielectrics; Knoxville, TN, USA (7 Mar 1982).

The use of various fluorinated compounds as insulating media for electric power transmission facilities is an example of a developing technology which may affect human health. Data on cytotoxicity, generated when the species, Saccharomyces cerevisiae, was exposed to perfluoro-2-butyne (PFB), sulfur hexafluoride (SF_6), sulfur dioxide (SO_2), octafluorocyclobutane (c-C_4F_8), and hexafluorocyclobutene (c-C_4F_6) are discussed. How such data when combined with biological data on well characterized toxic agents, can serve as input to an estimate of the human health impact or acceptable exposure limits for these fluorinated compounds is described.

40718 **(DOE/ET/29239—1) Basic study of the aging process in solid dielectric cables. Part II. Bibliography.** Derringer, G.C.; Epstein, M.M.; Gaines, G.B.; Luttinger, M.; McGinniss, V.D.; Thomas, R.E. (Battelle Columbus Labs., OH (USA)). Feb 1982. Contract AC01-77ET29239. 97p. NTIS, PC A05/MF A01. Order Number DE82009177.

A partially annotated bibliography of 782 references on the aging of dielectrics used for extruded power cables is presented. The bibliography is prefaced by a brief description of the philosophy and methodology employed in carrying out the literature search, and of the mechanics of the review process itself. Following the bibliography is a series of subfiles listing reference numbers for specific subjects.

40719 **(PB—81-854812) Overhead power transmission. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 120p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the design, operation, control, performance, protection, and economics of overhead power transmission systems or networks. It provides theoretical and practical information about materials, equipment, and technology related to overhead power transmission. Some consideration is given to simulation and modeling of systems and equipment as well. Environmental and biological aspects of overhead tramsmission are excluded. (Contains 129 citations, fully indexed and including a table of contents.)

40720 **(PNL-SA—7529) X-ray monitoring of 230-kV cable potheads for maintenance inspections.** Lawrence, R.C. (Pacific Northwest Lab., Richland, WA (USA)). 1979. Contract AC06-76RL01830. 10p. (CONF-7904187—1). NTIS, PC A02/MF A01. Order Number DE82008594.

From Doble client conference; Boston, MA, USA (2 Apr 1979).

A system has been designed by which pothead connections and corresponding components can be radiographically inspected for high mechanical stresses and failure potential. The system, employing a ^{60}Co source with a special lead collimator, was used to make high-resolution radiographs of 230 kV potheads of cables in the high-pressure oil-filled pipe-type cable system at Grand Coulee Dam. The selection and use of the equipment are discussed. It was concluded from this operation that radiography can verify conditions of cables and potheads that could result in future problems. It cannot positively identify an imminent failure. This limitation of radiography should be recognized, and care must be exercised in the interpretation of inspection radiographs. However, there is a certain amount of confidence to be realized when the cable or pothead mechanical condition appears to be normal or as-designed, and when no changes can be observed over a period of time. With further development of radiographic techniques and special equipment, it should be possible to inspect the condition of cables inside steel-flange or ceramic potheads with a single type of cassette and a standard exposure geometry. (LCL)

40721 **Reliability analysis technique for bulk-system planning.** Ranade, S.J. Gainesville, FL; Univ. of Florida (1981). 197p. University Microfilms Order No. 82-03,710.

Thesis (Ph. D.).

Bulk power system planning involves the development of generation and major transmission facilities so as to meet a prescribed reliability requirement at minimum cost. A systematic approach to bulk-system reliability analysis is presented. Two-state component models, a probabilistic demand model and a least square-error linearization of the a.c. power-flow equations, are used. The concept of Load-dependent Minimum Paths (LMP) is introduced and used to define subsets of states according to supply capability. These subsets are used to develop a probabilistic supply model which, combined with the demand model, yields reliability measures. LMPs also clearly point out the deficiencies in the system and suggest augmentation strategies to the planner. The probability distribution of demand not served is proposed as a planning criterion. This distribution is used to develop the Augmentation Function (AF) which indicates how the supply characteristics

of the system must be modified in order to achieve the prescribed reliability. While the AF suggests demand levels at which system performance is to be improved, LMPs suggest contingencies that must be reinforced and expansion strategies likely to provide such reinforcement. In order to unify generation and transmission planning, these strategies are expressed as power injections into a bus or power-flow changes along corridors. The most-effective strategies are selected on the basis of the sensitivity of demand curtailed in the various contingency states. The selected strategies are then interpreted as actual equipment additions, to postulate alternative expansion plans.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 40704, 40756, 40787

40722 (DOE/NE—0021) Nuclear-related training and education offered by academic institutions (less than baccalaureate degree) (preliminary). Howard, L. (Oak Ridge Associated Universities, Inc., TN (USA)). Nov 1981. Contract AC05-76OR00033. 58p. NTIS, PC A04/MF A01. Order Number DE82009345.

This study presents the results of a survey of academic institutions offering nuclear-related training and education at the less than baccalaureate degree level. The scope of the survey includes only those programs which have a nuclear power industry application, and excludes all programs which are affiliated with nuclear medicine. The survey instrument was distributed by the Institute of Nuclear Power Operations to 262 academic institutions. The survey universe was compiled from a number of publications that listed nuclear-related academic programs. Since the initial mailing in May 1981, ten of the institutions have been determined to no longer exist and eight other listings have been identified as duplications, thus reducing the universe to 244 institutions. Fifty-five percent of the survey population (134 institutions) responded to the questionnaire, of which 45 percent (109) were out of the survey scope and 10 percent (25) indicated they offered less than baccalaureate degree, nuclear-related programs.

40723 (DOE/NE—0031) Study of a Federal Nuclear Operations Corps. (USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Nuclear Power Systems). Dec 1981. 8p. NTIS, PC A02/MF A01. Order Number DE82008971.

The staffing requirements of the nuclear electric utility industry will create very large demands in the next 3 years for nuclear trained personnel in operation and maintenance. The commercial nuclear industry recognizes these needs, the importance of having qualified trained personnel, and is taking appropriate action to satisfy these requirements. The education and training capabilities both inside and outside of the utility industry have the capacity to meet these demands if they are properly managed. In particular, the Institute of Nuclear Power Operations Human Resource Management System provides a framework for an organized industry-wide program. The Nuclear Regulatory Commission's Office of Inspection and Enforcement is in effect a Federal Corps focused on nuclear operations. Its Reactor Training Center trains the professionals required to inspect nuclear operations and enforce regulations. Therefore, the Department of Energy (DOE) believes that the objectives of a Federal Nuclear Operations Corps can be met by existing private and Federal efforts and that there is no need to establish another corps or training academy. This is consistent with the Administration's policy of minimizing the Federal role in areas where the private sector is capable.

40724 (INIS-mf—6838) Summary of activities July 1980-July 1981. (Stichting Energieonderzoek Centrum Nederland, The Hague). Jul 1981. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700746.

Brief reviews are given of the activities of ECN related to fission energy, fusion energy and superconductivity, energy from fossil fuels, wind energy, utilization of the Petten research reactors, organization and staff and finance.

40725 (NUREG—0748-Vol.2-No.3) Operating reactors licensing actions summary. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Apr 1982. 363p. GPO.

Portions of document are illegible.

The operating reactors licensing actions summary is designed to provide the management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors. These reports utilize data collected from the Division of Licensing in the Office of Nuclear Reactor Regulation and are prepared by the Office of Management and Program Analysis.

40726 Alternative energy sources. Part B. Manassah, J.T. (ed.). New York, NY; Academic Press, Inc. (1981). 407p. (CONF-800295—Pt.B). Academic Press, Inc., 111 Fifth Ave., New York, NY 10003.

From Symposium on alternative energy sources; Kuwait, Kuwait (1 Feb 1980).

This text has been assembled from the proceedings of the Alternative Energy Sources Symposium of the International Symposium Series of the Kuwait Foundation for the Advancement of Sciences (KFAS) that was held in Kuwait in February 1980. The focus of this symposium was to review and assess those technologies that presently complement and will most likely substitute in the future for oil and gas extracted by conventional techniques. This text includes the state-of-the-art of these technologies as seen by experts in their respective disciplines. In the coverage of the technologies presented, an attempt has been made to include present developed technologies and those under development. As a consequence, the level of detail in each presentation is appropriate to the developmental stage of the technology under consideration, as assessed by the author. In general, the papers covering proven or nearly proven technologies mostly consist of detailed and or comparative assessments of the diverse engineering schemes without unduly dwelling on basics, while papers addressing technologies under development review the theoretical basis of these technologies in some details. In all instances where meaningful economics are available, numbers are included. This text also includes review papers of electric storage technology and transportation and energy, topics that, along with conservation, affect most strategic energy planning for the foreseeable future. The text also includes economics methodology and economical development papers that will hopefully allow researchers in the energy field access to the more common tools and approaches of the economic and financial analysts and the international development economists. Separate abstracts of individual presentations have been prepared for inclusion in the Energy Data Base. (DMC)

40727 Nuclear fission power plants: the state of the art. El-Wakil, M.M. (Univ. of Wisconsin, Madison). pp 519-605 of Alternative energy sources. Part B. Manassah, J.T. (ed.). New York, NY; Academic Press (1981).

From Symposium on alternative energy sources; Kuwait, Kuwait (1 Feb 1980).

This paper begins with historical and introductory remarks. It then describes the reactor types and existing examples. Other types that received some attention but are now largely ignored, such as, the fluid-fueled and organic-cooled reactors, are mentioned only in the introduction. Special reactors not part of the energy picture, such as, training and production reactors, are not covered. The fast breeder reactor, when fully developed, will be the primary, and probably inevitable, energy source during much of the next century. The paper terminates with a discussion of the vexing problem, in the public view, of the safe disposal of spent nuclear fuel.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 40745, 40753, 40760, 40766, 40767, 40768, 40771, 40774, 40790, 40805, 40814, 40819, 41461

40728 (Ds-I—1981-3) Steam explosions in light water reactors. Report of the Swedish Government Committee on Steam Explosions. (Industridepartementet, Stockholm (Sweden)). 1981. 200p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE82700594.

The report deals with a postulated accident caused by molten fuel falling into the lower plenum of the containment of a reactor. The analysis which is presented in the report shows that the thermal energy released in the resulting steam explosion is not enough to destroy the pressure vessel or the containment. The report was prepared for the Swedish Governmental Committee on steam explosion in light water reactors. It includes statements issued by internationally well-known specialists.

40729 (JAERI-M—9251) FEMAXI-III: an axisymmetric finite element fuel behavior code. Nakajima, T.; Ichikawa, M.; Iwano, Y.; Ito, K.; Saito, H.; Kashima, K.; Kinoshita, M.; Okubo, T. (Japan Atomic Energy Research Inst., Tokyo). Jan 1981. 67p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82700740.

An axisymmetric finite element code, FEMAXI-III, has been developed for the detailed analysis of localized deformation of fuel rods, which is closely related to PCI failures in LWR. The major feature of the code are as follows. Thermal/mechanical processes of fuel rod such as heat conduction, fission gas release, thermal expansion, elasto-plasticity, pellet cracking, densification, swelling and their interrelated effects are considered. Mechanical interaction (Contact problem) between pellet and cladding is more exactly treated, in which sliding or sticking is determined by iterative procedures. An implicit algorithm is applied to improve numerical stability at high creep rate range. Quadratic isoparametric elements are used to obtain a more accurate finite element solution. Pellet is assumed as a non-tension material. The change of pellet stiffness under compression is considered to be depending on its initial relocation.

40730 (NP—2904587) NAIG annual review. Ueda, M.; Adachi, H.; Sakurada, K. (Nippon Atomic Industry Group Co. Ltd., Tokyo). 1981. 68p. Nippon Atomic Industry Group Co., Ltd., 13-12, Mita 3-chome, Minato-ku, Tokyo, Japan.

Information on reactor physics, reactor engineering, reactor chemistry, and electronics is presented for PWR, BWR, LMFBR, and thermonuclear reactors.

40731 (PB—81-240897) Nuclear powerplant standardization: light water reactors. Volume 2. Appendixes. (Office of Technology Assessment (U.S. Congress), Washington, DC). Jun 1981. 428p. NTIS, PC A19/MF A01.

This volume contains working papers written for OTA to assist in preparation of the report, NUCLEAR POWERPLANT STANDARDIZATION: LIGHT WATER REACTORS. Included in the appendixes are the following: the current state of standardization, an application of the principles of the Naval Reactors Program to commercial reactors; the NRC and standardization, impacts of nuclear powerplant standardization on public health and safety, descriptions of current control room designs and Duke Power's letter, Admiral Rickover's testimony, a history of standardization in the NRC, and details on the impact of standardization on public health and safety.

40732 (UCID—19128) Technical evaluation of the monitoring of electric power to the reactor protection system for the Cooper Nuclear Station. Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 2 Mar 1982. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01. Order Number DE82009347.

This report documents the technical evaluation of the monitoring of electric power to the reactor protection system (RPS) at the Cooper Nuclear Station. The evaluation is to determine if the proposed design modification will protect the RPS from abnormal voltage and frequency conditions which could be supplied from the power supplies and will meet certain requirements set forth by the Nuclear Regulatory Commission. The proposed design modifications with time delays verified by GE, will protect the RPS from sustained abnormal voltage and frequency conditions from the supplying sources.

40733 (UCID—19129) Technical evaluation of the monitoring of electric power to the reactor protection system for the Duane Arnold Energy Center. Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 1 Mar 1982. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01. Order Number DE82009317.

This report documents the technical evaluation of the monitoring of electric power to the reactor protection system (RPS) at the Duane Arnold Energy Center. The evaluation is to determine if the proposed design modification will protect the RPS from abnormal voltage and frequency conditions which could be supplied from the power supplies and will meet certain requirements set forth by the Nuclear Regulatory Commission. The proposed design modifications will protect the RPS from sustained abnormal voltage and frequency conditions from the supplying sources.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 40728, 40729, 40730, 40731, 40746, 40753, 40766, 40767, 40768, 40769, 40771, 40780, 40790, 40792, 40793, 40794, 40795, 40796, 40799, 40813, 40814, 40819, 40821, 41328

40734 (NUREG—0720) Power plant siting and design: a case study of minimal entrainment and impingement impacts at Davis-Besse Nuclear Power Station. Staff technical report 1977-1978. Hickey, C.R. Jr. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1980. 43p. NTIS, PC A03/MF A01.

Fish impingement and ichthyoplankton entrainment were studied during 1977 and 1978 at the Davis-Besse Nuclear Power Station, located on the southwestern shore of Lake Erie, Ohio. The estimated losses of impinged fishes plus the equivalent adults of entrained eggs and larvae were small fractions of the recreational and commercial fishery harvests from Ohio waters of Lake Erie. By comparison, the losses were 1-4 orders of magnitude less than at other Lake Erie power plants. The findings should provide useful information for the feedback process from operational experience to siting and design of future power plants on Lake Erie, and from operational experience to impact assessment and prediction.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 40752, 40758

40735 (JAERI-M—9264) PLATO: a computer code for the analysis of fission product plateout in HTGRs. Suzuki, K.; Morimoto, T. (Japan Atomic Energy Research Inst., Tokyo). Jan 1981. 32p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82700742.

The computer code PLATO for estimating plateout activities on surfaces of primary cooling system of HTGRs has been developed, and in this report, analytical model and digital calculation method incorporated in the code are described. The code utilizes the mass transfer model analogous to heat transfer coupled with an expression for adsorption-desorption phenomenon, and is able to analyze plateout behaviors in a closed circuit, like a reactor cooling system, which is constructed from a various kind of components, as well as in an open-ended tube. With the code, fission product concentration in the coolant and plateout amount on the surfaces are calculated along the coolant stream, and total removal rate by the plateout process is also obtained. Comparison of the analytical results with the experimental results, including checks of the effects of some calculation conditions on the results, and preliminary analysis on the VHTR plant have been made.

40736 Cavity closure arrangement for high pressure vessels. Amtmann, H.H. (to Department of Energy). US Patent 4,303,177. 1 Dec 1981. Filed date 5 Mar 1979. vp.
PAT-APPL-017418.

Described is a closure arrangement for a pressure vessel such as the pressure vessel of a high temperature gas-cooled reactor wherein a liner is disposed within a cavity penetration in the reactor vessel and defines an access opening therein. A closure is adapted for sealing relation with an annular mounting flange formed on the penetration liner and has a plurality of radially movable locking blocks thereon having outer serrations adapted for releasable interlocking engagement with serrations formed internally of the upper end of the penetration liner so as to effect high strength closure hold-down. In one embodiment, ramping surfaces are formed on the locking block serrations to bias the closure into sealed relation with the mounting flange when the locking blocks are actuated to locking positions.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 40730, 40753, 40788, 40809, 41142

40737 (CONF-820306—4) Lifetime improvement of sheathed thermocouples for use in high-temperature and thermal transient operations. McCulloch, R.W.; Clift, J.H. (Oak Ridge National Lab., TN (USA); Oak Ridge Y-12 Plant, TN (USA)). 1982. Contract W-7405-ENG-26. 34p. NTIS, PC A03/MF A01. Order Number DE82008844.

From 6. symposium on temperature; Washington, DC, USA (14 Mar 1982).

Premature failure of small-diameter, magnesium-oxide-insulated sheathed thermocouples occurred when they were placed within nuclear fuel rod simulators (FRSs) to measure high temperatures and to follow severe thermal transients encountered during simulation of nuclear reactor accidents in Oak Ridge National Laboratory (ORNL) thermal-hydraulic test facilities. Investigation of thermally cycled thermocouples yielded three criteria for improvement of thermocouple lifetime: (1) reduction of oxygen impurities prior to and during their fabrication, (2) refinement of thermoelement grain size during their fabrication, and (3) elimination of prestrain prior to use above their recrystallization temperature. The first and third criteria were satisfied by improved techniques of thermocouple assembly and by a recovery anneal prior to thermocouple use.

40738 (PB—81-854887) Breeding blankets. January 1976-November 1980 (citations from the NTIS Data Base). Report for January 1976-November 1980. (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 205p. NTIS PC N01/MF N01.

The bibliography cites reports on studies, designs, and applications of breeding blankets for nuclear fission and fusion. (Contains 200 citations, fully indexed and including a table of contents.)

40739 (PB—81-854895) Breeding blankets. January 1970-November 1980 (citations from the Energy Data Base). Report for January 1970-November 1980. (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 192p. NTIS PC N01/MF N01.

Global information covers citations on studies, designs, and applications of breeding blankets for nuclear fission and fusion. (Contains 200 citations, fully indexed and including a table of contents.)

40740 (PB—81-854903) Breeding blankets. January 1970-November 1980 (citations from the Engineering Index Data Base). Report for January 1970-November 1980. (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 153p. NTIS PC N01/MF N01.

Global information covers citations on studies, designs and applications of breeding blankets for nuclear fission and fusion. (Contains 135 citations, fully indexed and including a table of contents.)

40741 Prediction of decay heat removal capabilities for LMFBRs and comparison with experiments. Agrawal, A.K.; Khatib-Rahbar, M.; Madni, I.K. (Brookhaven National Lab., Upton, NY (USA). Dept. of Nuclear Energy). *Nuclear Engineering and Design;* **66**: No. 3, 437-446(Sep 1981).

The decay heat removal capability of LMFBR plants is investigated in two steps: the transition phase and the established phase of natural circulation. Major parameters affecting the transition phase are briefly reviewed. This paper, then, considers two analytical approaches to study plant behaviour for the established phase, i.e., the long-term heat dissipation capability of the plant. Advanced thermohydraulic system simulation codes (SSC-L and SSC-P) are used to study the response of the CRBRP, FFTF and PHENIX plants. Simplified analyses were also performed for plants, as well as to interpret the actual whole plant test data from PFR, PHENIX and EBR-II. All of these studies have shown that the mixed mean reactor core temperature rise is proportional to the 0.58 exponent of the shutdown steady power level.

40742 Fast breeder reactors. Waltar, A.E.; Reynolds, A.B. Elmsford, NY; Pergamon Press (1981). 877p. (DOE/NBM—2014658). Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, NY 10523.

This book describes the major design features of fast breeder reactors and the methods used for their design and analysis. The foremost objective of this book is to fulfill the need for a textbook on Fast Breeder Reactor (FBR) technology at the graduate level or the advanced undergraduate level. It is assumed that the reader has an introductory understanding of reactor theory, heat transfer, and fluid mechanics. The book is expected to be used most widely for a one-semester general course on fast breeder reactors, with the extent of material covered to vary according to the interest of the instructor. The book could also be used effectively for a two-quarter or a two-semester course. In addition, the book could serve as a text for a course on fast reactor safety since many topics other than those appearing in the safety chapters relate to FBR safety. Methodology in fast reactor design and analysis, together with physical descriptions of systems, is emphasized in this text more than numerical results. Analytical and design results continue to change with the ongoing evolution of FBR design whereas many design methods have remained fundamentally unchanged for a considerable time.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 40800, 40801

40743 (INIS-mf—6734) Licensing of nuclear power plants in the Federal Republic of Germany. A comparative law study. da Costa Lima, W.A. (Universidade do Estado do Rio de Janeiro (Brazil)). Apr 1978. 221p. (In Portuguese). NTIS (US Sales Only), PC A10/MF A01. Order Number DE82780062.

The procedure for the licensing of nuclear power plants in the Federal Republic of Germany is outlined, the organizations involved with such procedure being mentioned.

40744 (NUREG—0020-V5-N7) Licensed operating reactors: status summary report, data as of 6-30-81. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Management and Program Analysis). Jul 1981. 387p. NTIS, PC A17/MF A01.

The Operating Units Status Report - Licensed Operating Reactors provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the Office of Management and Program Analysis from the Headquarters staff of NRC's Office of Inspection and Enforcement, from NRC's Regional Offices, and from utilities. The three sections of the report are: monthly highlights and statistics for commercial operating units, and errata from previously reported data; a compilation of detailed information on each unit, provided by NRC's Regional Offices, IE Headquarters and the utilities; and an appendix for miscellaneous information such as spent fuel storage capability, reactor-years of experience and non-power reactors in the U.S. It is hoped the

report is helpful to all agencies and individuals interested in maintaining an awareness of the U.S. energy situation as a whole.

40745 **(NUREG—0123-REV-3) Standard Technical Specifications for General Electric Boiling Water Reactors (BWR/5).** Bottimore, R.R. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1980. 406p. NTIS, PC A18/MF A01.

The Standard Technical Specifications for General Electric Boiling Water Reactors (GE-STS) is a generic document prepared by the US NRC for use in the licensing process of current General Electric Boiling Water Reactors. The GE-STS sets forth the limits, operating conditions, and other requirements applicable to nuclear reactor facility operation as set forth by Section 50.36 of 10 CFR Part 50 for the protection of the health and safety of the public. The document is revised periodically to reflect current licensing requirements.

40746 **(NUREG—0212-REV-2) Standard Technical Specifications for Combustion Engineering Pressurized Water Reactors.** Vito, D.J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1980. 431p. NTIS, PC A19/MF A01.

The Standard Technical Specifications for Combustion Engineering Pressurized Water Reactors (CE-STS) is a generic document prepared by the US NRC for use in the licensing process of current Combustion Engineering Pressurized Water Reactors. The CE-STS sets forth the limits, operating conditions, and other requirements applicable to nuclear reactor facility operation as set forth by Section 50.36 of 10 CFR 50 for the protection of the health and safety of the public. The document is revised periodically to reflect current licensing requirements.

40747 **(NUREG—0390-V5-N1) Topical report review status. Bi-annual report 15 July 1980-15 July 1981.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Management and Program Analysis). Jul 1981. 225p. NTIS, PC A10/MF A01.

The primary purpose of this document is to provide periodic progress reports of on-going topical report reviews, to identify those topical reports for which the Nuclear Regulatory Commission (NRC) staff review has been completed and, to the extent practicable, to provide NRC management with sufficient information regarding the conduct of the topical report program to permit taking whatever actions deemed necessary or appropriate.

40748 **(NUREG—0748-V1-N5) Operating reactors licensing actions summary.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Management and Program Analysis). Aug 1981. 290p. NTIS, PC A13/MF A01.

The Operating Reactors Licensing Actions Summary is designed to provide the management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors.

40749 **(NUREG—0795) Comments on the NRC safety research program budget for Fiscal Year 1983.** (Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Reactor Safeguards). Jul 1981. 57p. NTIS, PC A04/MF A01.

Recommendations of the Advisory Committee on Reactor Safeguards are presented to the Commissioners for their consideration for FY 83 budget for the NRC safety research program.

40750 **(NUREG—0839) Survey by senior NRC management to obtain veiwpoints on the safety impact of regulatory activities from representative utilities operating and constructing nuclear power plants.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Inspection and Enforcement). Aug 1981. 55p. NTIS, PC A04/MF A01.

A survey of licensee staff members representing the several organizational elements in different licensee corporate and plant staffs was conducted by senior NRC management to obtain licensee views on the potential safety consequences and impact of NRC regulatory activities. The comments received addressed the full scope of NRC activities and the negative impact of agency actions on licensee resources, staff performance, planning and scheduling, and organizational effectiveness. The findings of the survey is that the pace and nature of regulatory actions have created a potential safety problem which deserves further evaluation by the agency.

40751 **Upgrading of quality assurance programmatic requirements for operating nuclear power plants.** Haass, W.P. (Nuclear Regulatory Commission, Washington, DC (USA)). pp 49-54 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

From International symposium on quality assurance for nuclear power plants; Paris, France (11 May 1981).

As a result of the analysis of the TMI-2 accident and experience at several construction sites for nuclear power plants, the staff of the United States Nuclear Regulatory Commission (NRC) has concluded that certain quality assurance (QA) programmatic modifications relative to currently existing requirements should be made. These modifications are directed toward upgrading and strengthening the QA function at operating nuclear power plants to improve its effectiveness in identifying and correcting operational deficiencies in order to protect the public health and safety. Specific areas of QA programmatic upgrading include: 1. Improving management attitudes toward QA; 2. expanding the category of structures, systems and components to which the QA programme applies, to include all items that affect safety; 3. improving the organizational independence of the QA function from the performing functions; 4. increasing QA staffing levels and qualification requirements for QA personnel; 5. increasing the involvement of the QA organization in the inspection and verification of operational activities; and 6. increasing the involvement of the QA organization in the review and approval of quality-affecting documents. The NRC has developed new requirements in the above areas and has initiated their implementation on TMI-1 (re-start) and several other operational units at sites located near areas of high population density. It is ultimately planned to demand the implementation of these new requirements for all nuclear power plants under design and construction as well as in operation. These and other new requirements are also contemplated for implementation in new plants under design and construction.

2108 Economics

REFER ALSO TO CITATION(S) 40706, 40810, 40903, 40911

2109 Process Heat Reactors

REFER ALSO TO CITATION(S) 40348

40752 **(GEFR-SP—258) Status report on General Electric activities concerning high-temperature gas reactor reforming plant design and applications.** Pflasterer, G.R. (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). Sep 1981. Contract AC03-80ET34034. 22p. (CONF-8110127—2). NTIS, PC A02/MF A01. Order Number DE82007538.

From IAEA meeting on gas-cooled reactors; Minsk, USSR (12 Oct 1981).

Information is presented concerning incentives to develop the HTGR reforming plant; the US domestic market; applications including the HTGR thermochemical pipeline; and reformer plant design options.

22 NUCLEAR REACTOR TECHNOLOGY

REFER ALSO TO CITATION(S) 40922

2201 Theory And Calculation

40753 (HEDL-SA—2313) Status of fission-product data for fast and light-water reactors. Schenter, R.E.; England, T.R. (Hanford Engineering Development Lab., Richland, WA (USA); Los Alamos National Lab., NM (USA)). Jun 1981. Contract AC06-76FF02170. 27p. (CONF-810606—105). NTIS, PC A03/MF A01. Order Number DE82008422.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

Extensive fission product cross section, decay data and fission yield evaluated data libraries have recently been generated worldwide by laboratories from several countries. At the Petten and Bologna conferences on fission products and the Brookhaven workshop on data evaluation, status of these compilations was presented. The ENDF/B-V fission product file, for example, contains over 800,000 data entries. From these libraries, processed data files have been generated for both decay and cross section information. The current content and structure of these microscopic and processed data libraries are presented and their use and application to reactor physics analyses are reviewed. Individual sections for cross sections, decay data and fisson yields are presented.

40754 (JAERI-M—9151) EELOSS: the program for calculation of electron energy loss data. Tanaka, S. (Japan Atomic Energy Research Inst., Tokyo). Oct 1980. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82700738.

A computer code EELOSS has been developed to obtain the electron energy loss data required for shielding and dosimetry of beta- and gamma-rays in nuclear plants. With this code, the following data are obtainable for any energy from 0.01 to 15 MeV in any medium (metal, insulator, gas, compound, or mixture) composed of any choice of 69 elements with atomic number 1-94: (a) Collision stopping power, (b) Restricted collision stopping power, (c) Radiative stopping power, and (d) Bremsstrahlung production cross section. The availability of bremsstrahlung production cross section data obtained by the EELOSS code is demonstrated by the comparison of calculated gamma-ray spectrum with measured one in Pb layer, where electron-photon cascade is included implicitly. As a result, it is concluded that the uncertainty in the bremsstrahlung production cross sections is negligible in the practical shielding calculations of gamma rays of energy less than 15 MeV, since the bremsstrahlung production cross sections increase with the gamma-ray energy and the uncertainty for them decreases with increasing the gamma-ray energy. Furthermore, the accuracy of output data of the EELOSS code is evaluated in comparison with experimental data, and satisfactory agreements are observed concerning the stopping power.

40755 (RISO-R—442) Department of reactor technology. Annual progress report 1 January - 31 December 1980. (Risoe National Lab., Roskilde (Denmark)). Apr 1981. 55p. NTIS (US Sales Only), PC A04/MF A01/ Also available from Risoe Library, DK-4000 Roskilde, Denmark. Order Number DE81701040.

The activities of the Department of Reactor Technology at Risoe during 1980 are described. The work is presented in three chapters: General Information on the Department, Summary of the Department's Development during 1980, and Activities of the Department. Lists of staff, publications, computer programs, and test facilities are included.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 40737

2204 Control Systems

40756 (NUREG/CR—2586) Survey of methods for improving operator acceptance of computerized aids. Frey, P.R.; Kisner, R.A. (Oak Ridge National Lab., TN (USA)). Apr 1982. Contract W-7405-ENG-26. 25p. (ORNL/TM—8236). NTIS, PC A02/MF A01. Order Number DE82009406.

The success of current attempts to improve the operational performance and safety of nuclear power plants by installing computerized operational aids in the control rooms is dependent, in part, on the operator's attitude toward the aid. Utility experience with process computer systems indicates that problems may already exist with operator acceptance of computerized aids. The growth of the role that computers have in nuclear power plants makes user acceptance of computer technology an important issue for the nuclear industry. The purpose of this report is to draw from the literature factors related to user acceptance of computerized equipment that may also be applicable to the acceptance of computerized aids used in the nuclear power plant control room.

40757 Position indicator. Tanner, D.E. (to Department of Energy). US Patent 4,304,630. 8 Dec 1981. Filed date 19 Feb 1980. vp.

PAT-APPL-122295.

A nuclear reactor system is described in which a position indicator is provided for detecting and indicating the position of a movable element inside a pressure vessel. The movable element may be a valve element or similar device which moves about an axis. Light from a light source is transmitted from a source outside the pressure vessel to a first region inside the pressure vessel in alignment with the axis of the movable element. The light is redirected by a reflector prism to a second region displaced radially from the first region. The reflector prism moves in response to movement of the movable element about its axis such that the second region moves arcuately with respect to the first region. Sensors are arrayed in an arc corresponding to the arc of movement of the second region and signals are transmitted from the sensors to the exterior of the reactor vessel to provide indication of the position of the movable element.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 41425, 41461

40758 (NP—2902009) Environmental radiation surveillance program. Summary report, July-December 1981. (Colorado State Univ., Fort Collins (USA); Public Service Co. of Colorado, Denver (USA)). 1981. 146p. NTIS, PC A07/MF A01. Order Number DE82902009.

The power generating record for the Fort St. Vrain Nuclear Generating Station during the last half of 1981 is presented. The energy generation was slightly greater than during the first half of 1981 and the highest for any previous 6 month reporting period. A complete and detailed listing of radioactivity released by all effluent routes may be found in the Public Service Company of Colorado semiannual Effluent Release Report to the USNRC. Any correlation of radioactivity in environmental samples with the effluent release data is discussed. This analysis is in the sample type sections and in the summary section II.H.

40759 (SAND—81-0359C) Benchmark gamma-ray skyshine experiment. Nason, R.R.; Shultis, J.K.; Faw, R.E.; Clifford, C.E. (Sandia National Labs., Albuquerque, NM (USA); Kansas State Univ., Manhattan (USA); Radiation Research Associates, Inc., Fort Worth, TX (USA)). 1982. Contract AC04-76DP00789. 13p. (CONF-820321—2). NTIS, PC A02/MF A01. Order Number DE82008190.

From 4. ASTM-EURATOM symposium on reactor dosimetry; Gaithersburg, MD, USA (22 Mar 1982).

A benchmark gamma-ray skyshine experiment is descibed in which ^{60}Co sources were either collimated into an upward 150-deg conical beam or shielded vertically by two different thicknesses of concrete. A NaI(Tl) spectrometer and a high pressure ion chamber were used to measure, respectively, the energy spectrum and the 4π-exposure rate of the air-reflected gamma photons up to 700 m from the source. Analyses of the data and comparison to DOT discrete ordinates calculations are presented.

40760 **(TVA/ONR/WRF—81/8) Phipps bend nuclear plant construction effects monitoring report, October 19, 1980-October 18, 1981.** Carden, D.M.; Fehring, J.P.; Webb, D.H. (Tennessee Valley Authority, Knoxville (USA). Office of Natural Resources). Oct 1981. 48p. NTIS, PC A03/MF A01. Order Number DE82902284.

The aquatic monitoring program is directed primarily toward monitoring the effectiveness of controls used to reduce erosion and siltation losses contained in surface runoff originating from the site. This monitoring program is dynamic, being subject to periodic review and revision to reflect changes in project status and/or results of past monitoring activities. It consists of onsite monitoring of surface runoff, monitoring of point source discharges identified in the NPDES permit, and limited instream biological monitoring. The program is tied to a feedback mechanism for implementing corrective action before significant adverse impacts occur in the Holston River. This report evaluates the aquatic monitoring program for the fourth year of construction (October 19, 1980 through October 18, 1981) as required by the NPDES permit, Part III, Section I. Included in this evaluation are data from peripheral runoff monitoring, heavy rainfall sampling, and aquatic macrophyte monitoring.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 41126

40761 **(AD-A—103145/9) Reactor facility, Armed Forces Radiobiology Research Institute. Technical report.** Sholtis, J.A. Jr.; Moore, M.L. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). May 1981. 11p. NTIS, PC A02/MF A01.

The Armed Forces Radiobiology Research Institute (AFRRI) reactor is a TRIGA (Training, Research, and Isotope Production General Atomics Reactor) Mark-F pool-type thermal research reactor, capable of both pulsed and steady-state operation at a variety of locations in the pool. Designed and built by General Atomics, it first achieved criticality in 1962 with aluminum-clad fuel. In 1965, stainless-steel-clad fuel was installed and is still in use today. The AFRRI reactor serves as a mixed neutron and gamma source for Department of Defense radiation research. Although most of this research involves radiobiology including radioisotope production, the AFRRI reactor has also been used in support of Federal criminal investigations, studies of transient radiation effects on electronics, and artifact analysis.

40762 **(EGG-M—00682) Use of ASPEN in the analysis of thermodynamic cycles.** Fish, L.W.; Evans, D.R.; Madsen, W.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 9p. (CONF-820202—13). NTIS, PC A02/MF A01. Order Number DE82008606.

From AICHE 1982 national winter meeting; Orlando, FL, USA (28 Feb 1982).

In support of a number of programmatic activities of the Department of Energy (DOE) at the Idaho National Engineering Laboratory, analysis of the performance of low-temperature binary Rankine cycles for electrical power generation and estimation of the cost of the required equipment have been important technical areas for some time. In the past, these functions had been performed using separate computer programs designed for specific applications. Significant economies could be accomplished if it were possible to use a single computer program for all applications. In performing cycle analysis and cost estimation for the recovery of low-temperature thermal energy from the Advanced Test Reactor (ATR) at INEL, the ASPEN program was used, since it appeared to have the required capabilities.

40763 **(JAERI-M—9261) Development of the NSRR experimental data bank system, (1). Outline of processing program DTBNK, and the present status of the data bank system.** Ishijima, K.; Uemura, M.; Ohnishi, N. (Japan Atomic Energy Research Inst., Tokyo). Jan 1981. 62p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82700741.

To promote collection, arrangement, and utilization of the NSRR experimental data, development of the NSRR experimental data bank system was intended. Fundamental parts of the NSRR experimental data bank system, including the processing program DTBNK, have been completed. Data of the experiments performed so far have been collected and stored. Outline of the processing program and the method of utilization and the present status of the data bank system are discussed.

40764 **(ORNL/TM—5999/R1) Technical specifications for the Oak Ridge Research Reactor.** (Oak Ridge National Lab., TN (USA)). Mar 1982. Contract W-7405-ENG-26. 59p. NTIS, PC A04/MF A01. Order Number DE82009605.

Technical specifications are presented concerning safety limits and limiting safety system settings; limiting conditions for operation; surveillance requirements; design features; and administrative controls.

2207 Plutonium And Isotope Production Reactors

40765 **(IS—4787) Decommissioning the Ames Laboratory Research Reactor. A brief pictorial report.** Voigt, A. (Ames Lab., IA (USA)). 1981. Contract W-7405-ENG-82. 50p. NTIS, PC A50/MF A01. Order Number DE82007854.

The Ames Laboratory Research Reactor (ALRR) was designed in 1960-1961 and constructed in 1961-1965. It achieved criticality on February 17, 1965 and full power on July 12, 1965. Full time operation at its full power of 5 Megawatts was begun in June 1966 and continued through December 1977, producing a total of 15,200 Megawatt days of thermal energy. The decision to shut down the reactor at the end of 1977 was made in the summer of 1977. Planning and document preparation for decommissioning began at that time. The goal of removing all reactor-related radioactivity coupled with the realization that the building constitutes a valuable asset led DOE to select Removal of the Reactor Pedestal as the degree of decommissioning to be undertaken and budgeted. In planning, the work was divided into the following four phases and each of these into a number of tasks: (1) placing the reactor in stand-by status; (2) disposal of removable parts; (3) deactivation; and (4) removal of reactor pedestal. This report gives a detailed account of this operation with photos taken at various stages of the operation.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 40728, 40751, 41345, 41902

40766 **(DOE/NE—0032) Program management plan for the conduct of a research, development, and demonstration program for improving the safety of nuclear powerplants.** (USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Nuclear Power Systems). Dec 1981. 15p. NTIS, PC A02/MF A01. Order Number DE82008776.

Congress passed Public Law 96-567, Nuclear Safety Research, Development, and Demonstration Act of 1980, (hereafter referred to as the Act) to provide for an accelerated and coordinated program of light water reactor safety research, development, and demonstration to be carried out by the Department of Energy. In order to assure that this program would be compatible with the needs of Nuclear Regulatory Commission (NRC) and industry, the Department of Energy (DOE) initiated its response to Section 4 of the Act by conducting individual information gathering meetings with NRC and a wide cross section of the nuclear industry. The Department received recommendations on needs of what type of activities would and would not be appropriate for the Department to assist in satisfying these needs. Based on the evaluation of these inputs, it is concluded that the Department's ongoing Light Water Reactor (LWR) safety program is responsive to the Act. Specifically, the Department's ongoing program includes tasks in the areas of regulatory assessment, risk assessment, fission product source term, and emergency preparedness as well as providing technical assistance to the Institute of Nuclear Power Operations (INPO) to improve training of nuclear power personnel. These were among the very high priority efforts that were identified as necessary and appropriate for support by the Department.

40767 **(GRS-A—493) Post-test calculations and analysis of vessel burst tests with the program DAPSY.** Schuerkamp, H.; Badur, A. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). 1980. 48p. (In German). Gesellschaft fuer Reaktorsicherheit, (GRS) mbH-Glockengasse 2, Koeln, Germany.

Portions of document are illegible.

Computer code calculations accompanying experiments are carried out by GRS for the interpretation of the fluiddynamic measurements. In a first step experimental results for break area and fracture speed are used as input data for the fluiddynamic code DAPSY and the computer code system ADINA to describe the structure dynamics. With these codes experimental results should be evaluated theoretically in a second step with regard to coupling of fluiddynamic variables, with fracture mechanics and structure dynamic displacements. This report describes the check for the applicability of the code DAPSY by means of some pre-experiments carried out the MPA. The results of these postcalculations show partly good agreement in comparison with the measured test data.

40768 **(JAERI-M—9285) WREM-J2: a JAERI improved version of WREM code system.** Tanabe, F.; Fujiki, K.; Yoshida, K.; Matsumoto, K.; Ohkubo, S.; Sakano, K.; Yoshida, H.; Shimooke, T. (Japan Atomic Energy Research Inst., Tokyo). Jan 1981. 111p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82700744.

WREM (Water Reactor Evaluation Model) code system has been improved to WREM-J2 version by improving constitutive codes and developing new codes. By these improvements, WREM-J2 has prepared capability of closed evaluation analysis of LWR-LOCA including small break LOCA in the sense that needed quantities (peak cladding temperature and cladding oxide thickness) can be defined by this code system itself if initial conditions are supplied. Namely it has prepared capability of one-through calculation of BWR-LOCA including refill-reflood phase during which core spray system is actuated. Regarding PWR-LOCA analysis, it has prepared capability of calculating thermal radiation between fuel rods and structures, containment pressure calculation, and reflood calculation without using FLECHT-correlation. Furthermore, several improvements have been implemented for analyzing abnormal transients. This report describes an brief outline of constitutive codes of WREM-J2, methods of LWR-LOCA analysis and a part of improvements included in WREM-J2.

40769 **(JAERI-M—9286) REFLA-1D/MODE 1: a computer program for reflood thermo-hydrodynamic analysis during PWR-LOCA user's manual.** Murao, Y.; Sugimoto, J.; Okubo, T. (Japan Atomic Energy Research Inst., Tokyo). Jan 1981. 136p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE82700745.

This manual describes the REFLA-1D/MODE 1 reflood system analysis code. This code can solve the core thermo-hydrodynamics under forced flooding conditions and gravity feed conditions in a system similar to FLECHT-SET phase A. This manual describes the REFLA-1D/MODE 1 models and provides application information required to utilize REFLA-1D/MODE 1.

40770 **(KFK—3048) ZETHYD, a SSYST-module for solving simultaneously the heat conduction equation in the fuel rod and the energy equation in the coolant channel.** Ehnis, L. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Oct 1980. 72p. (In German). (IKE-Ber.—4-96). Kernforschungszentrum Karlsruhe GmbH, Germany.

The SSYST-Module ZETHYD calculates the heat transfer between a fuel rod and the coolant channel of a light water reactor (LWR). It is programmed in FORTRAN IV. ZETHYD provides a tool to analyze a LWR fuel rod during a postulated loss of coolant accident or to precalculate and design fuel rod experiments. The module solves simultaneously for a given time step the Fourier heat conduction equation for the fuel rod and the energy equation for the fluid in the coolant channel. Both differential equations are solved numerically by the finite difference method and various algorithms. The heat transfer coefficient between fuel rod cladding and coolant is computed by different correlations depending on the surrounding conditions.

40771 **(NP—2903870) Reactor Safety Research Program. Emergency core cooling project. Final report of the research project: development of a measurement method for determination of transient mass flows (water/steam) by signal correlation.** Immink, D.I.J. (Technische Univ. Berlin (Germany, F.R.). Inst. fuer Kerntechnik). Apr 1981. 46p. Institut fuer Kerntechnik, MarchstraBe 18, 1000 Berlin 10, Germany.

Within the projects RS 135 and RS 135 A a measurement method has been developed, that allows the determination of transient mass flows by separated measurement of fluid velocity (cross-correlation of 2 thermocouple-signals) and density (attenuation of x-ray beams). In this report different measures are presented to improve the results of velocity determination at very heterogeneous flows of water/steam and on the other side at single-phase flows of water or steam.

40772 **(NUREG—0606-V3-N3) Unresolved safety issues summary. Volume 3, Number 3. Aqua book.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Management and Program Analysis). 21 Aug 1981. 52p. NTIS, PC A04/MF A01.

The 'Unresolved Safety Issues' summary is designed to provide the management of the Nuclear Regulatory Commission with a quarterly overview of the progress and plans for completion of generic tasks addressing Unresolved Safety Issues reported to Congress pursuant to section 210 of The Energy Reorganization Act of 1974 as amended. This summary utilizes data collected from the Office of Nuclear Reactor Regulation, Office of Nuclear Regulatory Research, and the National Laboratories and is prepared by the office of Management and Program Analysis. The definition of what constitutes completion of an unresolved safety issue (USI) has recently been expanded to include the implementation of the technical resolution. This is in acknowledgement of the fact that real safety benefits occur only after the implementation has taken place. The schedules in this book include a milestone at the end of each action plan which represents the initiation of the implementation process both with respect to incorporation of the technical resolution in the NRC official guidance or requirements and also the application of changes to individual operating plants. The schedule for implementation will not normally be included in the task action plan(s) for the resolution of a USI since the nature and extent of the activities necessary to accomplish the implementation cannot normally be reasonably determined prior to the determination of a technical resolution. The progress and status for implementation of unresolved safety issues for which a technical resolution has been completed are reported specifically in a separate table provided in this summary.

40773 **(NUREG—0807) Analysis of licensee event reports related to nuclear generating station onsite electrical system malfunctions, 1976-1978.** Bickel, J.H.; Abbott, E.C. (Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Reactor Safeguards). Jul 1981. 128p. NTIS, PC A07/MF A01.

This report summarizes the evaluation requested by the ACRS of 1177 LERS, submitted over a three year period, which related to onsite electrical system malfunctions. The evaluation was carried out for the purposes of identifying specific failure modes and consequences, evaluating the assumptions used in WASH-1400 on the reliability of electrical equipment, and identifying specific sequences which are significant to plant safety. The analysis performed provides a more specific identification of onsite electrical system failure modes, sequences, and consequences than was established in WASH-1400.

40774 **(NUREG—0808) Mark II containment program load evaluation and acceptance criteria; Generic Technical Activity A-8.** Anderson, C.J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Aug 1981. 92p. NTIS, PC A05/MF A01.

The report provides a discussion of LOCA-related suppression pool hydrodynamic loads in boiling water reactor (BWR) facilities with the Mark II pressure-suppression containment design. This report concludes NRC Generic Technical Activity A-8, 'Mark II Containment Pool Dynamic Loads,' which has been designated

an 'Unresolved Safety Issue' pursuant to Section 210 of the Energy Reorganization Act of 1974.

40775 **(NUREG—0810) Standard review plan for the review of radiological contingency plans for fuel cycle and materials facilities.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Fuel Cycle and Material Safety). Jul 1981. 40p. NTIS, PC A03/MF A01.

The Standard Review Plan (SRP) has been prepared for the guidance of staff reviewers in the Office of Nuclear Material Safety and Safeguards in performing reviews of Radiological Contingency Plans. The purpose of the SRP is to define acceptance criteria to assure that uniform and complete reviews are made by different reviewers.

40776 **(NUREG/CP—0019) Conference proceedings for cooperative research program for safety evaluation methods of concrete nuclear structures held at Skokie, Illinois on November 20, 1980.** Oesterle, R.G.; Russell, H.G. (Portland Cement Association, Skokie, IL (USA). Construction Technology Labs.). Jul 1981. 212p. NTIS, PC A10/MF A01.

From Cooperative research program for safety evaluation methods of concrete nuclear structures; Skokie, IL (20 Nov 1980).

A meeting to discuss a cooperative research program was held on November 20, 1980, in Skokie, Illinois, at the headquarters of the Construction Technology Laboratories of the Portland Cement Association. This meeting was jointly sponsored by the U.S. Nuclear Regulatory Commission and the Portland Cement Association. Representatives from the Nuclear Regulatory Commission, electric utility companies, architecture-engineering companies, construction companies, Electric Power Research Institute, and organizations currently performing NRC sponsored research attended. The first part of the meeting was devoted to presentations of results of research sponsored by the Nuclear Regulatory Commission. In addition, presentations describing construction problems currently resulting from existing design requirements were made. The second part of the meeting was devoted to a presentation of a proposed cooperative program to expand the scope of previous research work. A considerable amount of discussion resulted from the presentations. The purpose of this report is to present a transcript of the presentations and discussions during the meeting. It is anticipated that the report will contribute to a better understanding of the need for additional research on the proposed subjects.

40777 **(NUREG/CR—1508) Evaluation of the cost effects on nuclear power plant construction resulting from the increase in seismic design level. Technical report.** Stevenson, J.D. (Woodward-Clyde Consultants, Cleveland, OH (USA)). Apr 1981. 92p. NTIS, PC A05/MF A01.

This report presents the incremental cost of an 1100-to-1300-MWe nuclear power plant as a function of a range of seismic design requirements. The range of seismic intensity investigated is between 0.2-g and 0.6-g zero period ground acceleration for a safe shutdown earthquake. Two sets of costs are considered: one at a site where foundation liquefaction is a design consideration and the second where liquefaction is not a design consideration. Best estimate direct plus A/E (architect/engineer) engineering costs for a nonliquefaction site are from $16,200,000 to $43,800,000 (1977 dollars) and in the seismic range between 0.2-g and 0.6-g safe shutdown earthquake zero period ground acceleration. For sites where liquefaction is considered, the best estimate range is from $24,400,000 to $55,800,000. Percent of total plant costs range from 3.2 to 8.8 for nonliquefaction sites to 4.8 to 11.2 to liquefaction sites. These percentages are based on total direct and A/E engineering costs for the power-generating facility. If only those direct and A/E engineering costs associated with the nuclear steam supply system (nuclear island) are considered, the percentage increase associated with the seismic requirement would be approximately double those given above.

40778 **(NUREG/CR—1808) Countercurrent air/water and steam/water flow above a perforated plate. Report for October 1978-October 1979.** Hsieh, C.; Bankoff, S.G.; Tankin, R.S.; Yuen, M.C. (Northwestern Univ., Evanston, IL (USA). Dept. of Chemical Engineering). Nov 1980. 164p. NTIS, PC A08/MF A01.

The perforated plate weeping phenomena have been studied in both air/water and steam/cold water systems. The air/water experiment is designed to investigate the effect of geometric factors of the perforated plate on the rate of weeping. A new dimensionless flow rate in the form of H star is suggested. The data obtained are successfully correlated by this H star scaling in the conventional flooding equation. The steam/cold water experiment is concentrated on locating the boundary between weeping and no weeping. The effects of water subcooling, water inlet flow rate, and position of water spray are investigated. Depending on the combination of these factors, several types of weeping were observed. The data obtained at high water spray position can be related to the air/water flooding correlation by replacing the stream flow rate to an effective stream flow rate, which is determined by the mixing efficiency above the plate.

40779 **(NUREG/CR—1875) Evaluation of emergency operating procedures for nuclear power plants. Final report Feb 80-Mar 81.** Fuchs, F.; Engelschall, J.; Imlay, G. (XYZYX Information Corp., Canoga Park, CA (USA)). Apr 1981. 42p. NTIS, PC A03/MF A01.

The report documents the first of two tasks performed for the NRC relative to emergency operating procedures for nuclear power plants with special emphasis on LOCA procedures. Emergency procedures from nine plants have been evaluated. The recommendations regarding each plant's emergency procedures were made in separate reports. In this report, an analysis is made of problems common to emergency procedures in all nine plants. Recommendations are advanced for improvement in presentation style, level of detail, and administrative control.

40780 **(NUREG/CR—1973) Entrainment and deposition studies in two-phase cross flow: comparison between air-water and steam-water in a square horizontal duct. Technical report (final).** Berryman, R.J.; Ralph, J.C.; Wade, C.D. (UKAEA Atomic Energy Research Establishment, Harwell. Engineering Sciences Div.). Mar 1981. 67p. NTIS, PC A04/MF A01.

Air-water simulation studies of two phase steam water flow relevant to the upper plenum of a PWR during reflood situations have recently been undertaken at Harwell for the US Nuclear Regulatory Commission. In order to give confidence that the simulation fluids were capable of modelling the important features of the actual system, a relatively basic comparison experiment has been carried out. Water entrainment and deposition tests have been carried out on a pair of 2.5 cm diameter vertical rods mounted in a cross flow of steam or air in a 10.2 cm x 10.2 cm tunnel. The air and steam systems exhibited similar characteristics to one another. A 'critical' film flowrate was identified for the rods which, once reached, either by injection through the sinters or by entrainment from the main two phase stream, was not exceeded with further water addition. The 'critical' film flowrate decreased with increase of cross flow velocity and was lower for air than steam at the same velocity. The results from the air and steam tests were found to be reasonably well correlated on the basis of the cross flow momentum flux of the air or steam.

40781 **(NUREG/CR—1978) State-of-the-art study concerning near-field earthquake ground motion. Technical report (final) September 19780-October 1980.** Swanger, H.J.; Day, S.M.; Murphy, J.R.; Guzman, R. (Systems, Science and Software, La Jolla, CA (USA)). Mar 1981. 155p. NTIS PC A08/MF A01.

This report presents a summary of an investigation into the applicability of theoretical earthquake source modeling to the definition of design ground motion environments for nuclear power plants located in the near-field of potentially active faults. A variety of theoretical source models are examined to determine the characteristics of near-field ground motion predicted by such models and to isolate the sensitivities of high-frequency radiation characteristics to specific elements of the models. It is concluded that the high frequency ground motions predicted by the models are quite sensitive to particular details of implementation for which data and theory provide rather poor constraints. Examination of dynamic earthquake models suggests guidelines for extrapolation of model param-

eters to new stress-drops and magnitudes which are contrary to those procedures already in use. Guidelines for future modeling efforts which may better quantify the uncertainties in such procedures are recommended. Also recommended are studies which may offer constraints useful for both empirical and theoretical modeling procedures.

40782 **(NUREG/CR—1986) An analysis of U.S. nuclear health and safety information dissemination to selected foreign countries. Topical report.** Kertesz, F.; Carroll, B.; Kernohan, R. (Franklin Research Center, Philadelphia, PA (USA)). Mar 1981. 257p. NTIS PC A12/MF A01.

The primary focus of the final report is the dissemination of nuclear safety information to regulatory officials and utility personnel in foreign countries which have imported reactors build in the United States. Six countries were selected for closer study: Mexico, Brazil, Korea, Taiwan, Spain, and Yugoslavia. Team members visited regulatory and utility officials and site representatives of the U.S. vendors and architect/engineering firms. The material obtained from those interviewed, together with the earlier results from an interim study of domestic U.S. information sources, was used to describe the nuclear safety document acquisition practices of the six countries. The adequacies and weaknesses in the present dissemination methods were identified and presented in a tabular form, together with proposed solutions to the problems thus identified. Proposals which could be relatively easily realized were identified, and others which require further study were listed separately. Finally, several major proposals were described in greater length.

40783 **(NUREG/CR—1987) Light-water-reactor safety research program: quarterly progress report, July-September, 1980.** Massey, W.E.; Till, C.E. (Argonne National Lab., IL (USA)). Apr 1981. 18p. (ANL—81-15). NTIS PC A02/MF A01.

The progress report summarizes the Argonne National Laboratory work performed during July, August, and September 1980 on water-reactor-safety problems. The research and development area covered is Transient Fuel Response and Fission-product Release.

40784 **(NUREG/CR—1999) Human engineering guidelines for use in preparing emergency operating procedures for nuclear power plants. Technical report.** Fuchs, F.; Engelschall, J.; Imlay, G. (XYZYX Information Corp., Canoga Park, CA (USA)). Apr 1981. 63p. NTIS, PC A04/MF A01.

Emergency procedures for nuclear power plants were examined to include considerations of the development process, the circumstances of use, and the state of the art relative to procedure design. Recommendations were then formulated for NRC use in behalf of the entire industry. This report is presented in three sections. In Section 1, operator errors are analyzed for the purpose of showing how they can be affected by written procedures. In Section 2, an assessment is made of the emergency procedures from nine nuclear power plants. Deficiencies are examined in terms of the kinds of errors they could invite. In Section 3, recommendations are made on behalf of improved procedures throughout the industry. The recommendations include a model emergency procedure.

40785 **(NUREG/CR—2049) Strength and stiffness of reinforced concrete panels subjected to membrane shear, two-way and four-way reinforcing. Technical report.** Conley, C.H.; White, R.N.; Gergely, P. (Cornell Univ., Ithaca, NY (USA). Dept. of Structural Engineering). Apr 1981. 180p. NTIS, PC A09/MF A01.

This report presents results of an experimental program to investigate seismic shear transfer in a cracked reinforced concrete containment vessel. Both orthogonal (two-way) and four-way reinforcement patterns are studied. The test specimen was designed and constructed to simulate the stress state in the wall of a pressurized containment subjected to tangential shear stresses induced by an earthquake. 24 specimens were tested with a number of loading histories: constant biaxial tension followed by monotonic shear to failure, constant tension followed by incrementally increasing cyclic (reversing) shear to failure, shear followed by increasing tension, and simultaneous shear and tension. Four levels of biaxial tension, ranging from 0 to 0.9fy were used. Results are given for strength, stiffness, development of cracking, and degradation effects produced by cyclic shear. Comparisons are made between the results of an earlier investigation with higher steel ratios, between the 2-way and 4-way reinforced specimens, and between model tests and the panel tests, and design recommendations are made for both strength and stiffness.

40786 **(NUREG/CR—2175) Snubber sensitivity study. Technical assistant report (final) June 1978-July 1980.** Onesto, A.T. (Energy Technology Engineering Center, Canoga Park, CA (USA)). Jul 1981. 285p. (ETEC-TDR—80-16). NTIS, PC A13/MF A01.

Snubbers are used widely throughout the nuclear industry as seismic restraints. The validity of the analysis of snubber-supported systems depends on their realistic characterization. The purpose of this work was to: (1) identify those parameters which characterize hydraulic and mechanical snubbers which significantly affect snubber dynamic response, (2) determine the response sensitivity to variations of these parameters. Based upon the results of the foregoing, simplified design and analysis procedures are proposed, to maintain system response within acceptable limits.

40787 **(NUREG/CR—2211) Modeling of multiple sequential failures during testing, maintenance, and calibration.** Samanta, P.K. Mitra, S.P. (Brookhaven National Lab., Upton, NY (USA)). Dec 1981. Contract AC02-76CH00016. 77p. (BNL-NUREG—51411). NTIS, PC A05/MF A01. Order Number DE82008454.

In this report the nature of dependence among human failures in a multiple sequential action is analyzed and distinguished from other types of multiple failures. Human error causes selective failure of components depending on when the failure started. Two models are developed for quantifying the failure probability in a multiple sequential action. The first is very general in nature and does not require any dependent failure data. The failure probability obtained from this model is a conservative one with associated uncertainty. The uncertainty is calculated considering many possible sources such as data, coupling and modeling. In the second model, details of the process in multiple sequential failures are taken into account. The model increments the conditional failure probabilities by a certain amount from their lower bounds (independent failure probability). This approach provides important insights into the influence of dependence between failures on system reliability.

40788 **(NUREG/CR—2247) Acceleration induced fragmentation of liquid drops. Technical report Sep 79-Mar 81.** Pilch, M.; Erdman, C.A.; Reynolds, A.B. (Virginia Univ., Charlottesville (USA). Dept. of Nuclear Engineering). Aug 1981. 288p. NTIS, PC A13/MF A01.

Understanding drop breakup in gas flow fields and liquid flow fields is the goal of this work, which was originally motivated by LMFBR safety considerations. It is concluded that Rayleigh-Taylor (RT) instability plays a dominant role in all the observed breakup mechanisms. Existing experiment data is correlated over six decades of Weber number for the following topics: drop displacement, drop deformation, critical Weber number, breakup times, and fragment sizes. Many existing theories and models of drop breakup are shown to be physically unreasonable or inconsistent with experiment data. The maximum stable diameter concept is modified to include drop acceleration. Maximum stable fragment sizes are successfully predicted; mass median fragment sizes can also be calculated. The technique requires only empirical knowledge of drop displacement, total breakup time, and critical Weber number. Predicted stable fragment sizes for liquid-liquid systems are about five times larger than expected for gas-liquid systems.

40789 **(NUREG/CR—2269) Probabilistic models for the behavior of compartment fires. Technical report Oct 78-Nov 80.** Siu, N.O. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). Aug 1981. 179p. NTIS, PC A09/MF A01.

Physical models which predict the thermal hazards (including temperatures and heat fluxes) during a compartment fire as

functions of space and time are developed. Since large uncertainties are inherent to the analysis, the models are probabilistic. General models are constructed for the periods of fire growth and fully-developed burning. These models are used in sample analyses to estimate the fire hazard in particular compartments. The overall methodology requires the synthesis of a deterministic physical model from information available in the literature. Uncertainties in the input parameters required by the deterministic model are addressed and are incorporated with the uncertainties in the model itself, to form state of knowledge distributions for the thermal hazards.

40790 **(NUREG/CR—2334) Interphase transport in horizontal stratified cocurrent flow.** Jensen, R.J.; Yuen, M.C. (Northwestern Univ., Evanston, IL (USA). Dept. of Mechanical and Nuclear Engineering). May 1982. 197p. GPO$6.50.

The problem of interfacial transport in cocurrent, horizontal stratified gas-liquid systems is considered. Local condensation heat transfer coefficients and interface shear stress were obtained from mass and force balances. These balances were based on gas phase pitot traverses at various streamwise locations. Laser anemometer measurements of liquid mean and rms fluctuation velocities were made at similar locations. The laser anemometer data supported the value for the interface shear velocity obtained by the gas phase force balance. Based on cocurrent stratified air-water flow data the noncondensing interface shear stress was found to be a function of the relative velocity between the phases and the liquid fraction. Incorporated into Linehan's relation for condensing flow shear stress, the correlation was found to estimate the shear velocity for the condensation data considered. Local condensation heat transfer coefficients and gas absorption mass transfer coefficients were found to be directly proportional to the shear velocity.

40791 **(PB—81-140428) Analysis of forces on core structures during a loss-of-coolant accident. Final report.** Griggs, D.P.; Vilim, R.B.; Wang, C.H.; Meyer, J.E. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Aug 1980. 130p. NTIS, PC A07/MF A01.

There are several design requirements related to the emergency core cooling which would follow a hypothetical loss-of-coolant accident (LOCA). One of these requirements is that the core must retain a coolable geometry throughout the accident. A possible cause of core damage leading to an uncoolable geometry is the action of forces on the core and associated support structures during the very early (blowdown) stage of the LOCA. An equally unsatisfactory design result would occur if calculated deformations and failures were so extensive that the geometry used for calculating the next stages of the LOCA (refill and reflood) could not be known reasonably well. Subsidiary questions involve damage preventing the operation of control assemblies and loss of integrity of other needed safety systems. A reliable method of calculating these forces is therefore an important part of LOCA analysis. These concerns provided the motivation for the study. The general objective of the study was to review the state-of-the-art in LOCA force determination. Specific objectives were: (1) determine state-of-the-art by reviewing current (and projected near future) techniques for LOCA force determination, and (2) consider each of the major assumptions involved in force determination and make a qualitative assessment of their validity.

40792 **(PB—81-140436) Steam bubble collapse, water hammer and piping network response. Volume I. Steam bubble collapse and water hammer in piping systems: experiments and analysis. Final report.** Gruel, R.; Hurwitz, W.; Huber, P.; Griffith, P. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jun 1980. 50p. NTIS, PC A03/MF A01.

Water hammer incidents in conventional and nuclear steam systems are an important problem of broad general interest in piping network design and transient operation. Water hammer in PWR steam generator sparger feed lines has, for example, been a recurrent problem when the sparger becomes uncovered during certain operational transients (Creare 1977). The central goal of this research has been to develop experimental data and supporting analyses that will contribute to the evolving understanding of water hammer created by steam bubble entrapment in a pipe containing subcooled liquid. The first objective of this study has been to obtain a body of experimental data on water hammer initiated by steam bubble collapse. These experiments include measurement of pressure transients and high speed films of the process of bubble collapse and impact, and, in conjunction with Hurwitz (1980), records of the resultant pressure wave propagation through a variety of simple piping configurations and measurements of the induced structural response. The data that have been obtained should be useful in benchmarking existing analytic models and numerical codes.

40793 **(PB—81-140444) Steam bubble collapse, water hammer and piping network response. Volume II. Piping network response to steam generated water hammer. Final report.** Gruel, R.; Hurwitz, W.; Huber, P.; Griffith, P. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jun 1980. 83p. NTIS, PC A05/MF A01.

Conventional and nuclear power steam systems require the transport of high pressure, high temperature steam and water through complex piping networks. During transient phases of operation, steam and subcooled water can be present simultaneously in a variety of piping and reservoir configurations. Under certain conditions, instabilities in the two phase flows can give rise to water hammer events. Most notable are the water hammers experienced in the feed pipes to steam generator spargers in pressurized water nuclear reactors. This study combined with the work done by Gruel (1980) attempts to analyze the events which occur after the formation of an isolated steam vapor bubble. Experimental and theoretical models are developed to investigate the condensation process leading to steam bubble collapse, the mechanisms involved in the propagation of pressure waves through the pipes, and the resultant fluid-structure interactions.

40794 **(PB—81-191165) Three Mile Island nuclear reactor accident of March 1979. Environmental radiation data: Update 2, Volume I.** Hilton, B.A.; Grossman, R.F. (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.). Mar 1981. 520p. (EPA—600/4-81-014A). NTIS PC A22/MF A01.

The original report contains a listing of environmental radiation monitoring data collected in the vicinity of Three Mile Island (TMI) following the March 28, 1979 accident. These data were collected by the EPA, NRC, DOE, HHS, the Commonwealth of Pennsylvania, or the Bethlehem Steel Corporation. The original report was printed in September 1979 and the update was released in December 1979. This final update consists of additional data for 1979 by the same participating organizations, which has not been previously reported. Results of intercomparison studies carried out by the EPA to measure the reliability of the surveillance data entered into the data base, are also included in this final update.

40795 **(PB—81-191173) Three Mile Island nuclear reactor accident of March 1979. Environmental radiation data: Update 2, Volume II.** Hilton, B.A.; Grossman, R.F. (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.). Mar 1981. 489p. (EPA—600/4-81-014B). NTIS PC A21/MF A01.

The original report contains a listing of environmental radiation monitoring data collected in the vicinity of Three Mile Island (TMI) following the March 28, 1979 accident. These data were collected by the EPA, NRC, DOE, HHS, the Commonwealth of Pennsylvania, or the Bethlehem Steel Corporation. The original report was printed in September 1979 and the update was released in December 1979. This final update consists of additional data for 1979 by the same participating organizations, which has not been previously reported.

40796 **(PB—81-191181) Three Mile Island nuclear reactor accident of March 1979. Environmental radiation data: Update 2, Volume III.** Hilton, B.A.; Grossman, R.F. (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.). Mar 1981. 550p. (EPA—600/4-81-014C). NTIS PC A23/MF A01.

The original report contains a listing of environmental radiation monitoring data collected in the vicinity of Three Mile Island

(TMI) following the March 28, 1979 accident. These data were collected by the EPA, NRC, DOE, HHS, the Commonwealth of Pennsylvania, or the Bethlehem Steel Corporation. The original report was printed in September 1979 and the update was released in December 1979. This final update consists of additional data for 1979 by the same participating organizations, which has not been previously reported.

40797 **(PB—82-100504) Greater commitment needed to solve continuing problems at Three Mile Island. Report to the Congress.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 26 Aug 1981. 113p. NTIS, PC A06/MF A01.

The Nation's first major accident at a commercial nuclear-powered electricity generating station occurred at Three Mile Island over 2 years ago, yet the resolution of the resultant problems is still subject to regulatory and financial uncertainty. Consequently, little progress has been made to clean up the damaged facility or alleviate the extreme financial stress placed upon its owners. The remedies required to resolve the continuing problems at Three Mile Island will require unprecedented coordination and commitment by Federal and State regulatory bodies, the electric utility industry, the financial community, and the owners of the damaged facility. To safeguard against similar problems in the future, the Nuclear Regulatory Commission should develop accident recovery guidelines and ensure that increased property insurance coverage is available for nuclear facilities.

40798 **IAEA Code of Practice on quality assurance, and quality assurance requirements and practices in Member States.** Raisic, N. (International Atomic Energy Agency, Vienna (Austria). Div. of Nuclear Power). pp 3-22 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

From International symposium on quality assurance for nuclear power plants; Paris, France (11 May 1981).

The IAEA Code of Practice on Quality Assurance for Safety in Nuclear Power Plants and the corresponding Safety Guides are reviewed and compared with quality assurance (QA) practices in the IAEA Member States. The QA requirements stipulated by the Code place on the nuclear power plant owner the responsibility to establish an overall QA programme for the plant. In selecting the QA programme level for specific activities, the Code allows of a flexible approach but does not specify gradation in programme requirements. The Code is placing the burden of quality-achieving and quality-assuring functions on the task-performing organizations, namely the designers, manufacturers, constructors and plant operators. The plant owner provides for the management of the overall QA programme, surveillance of activities and verifications of the effectiveness of the constituent programmes of all project participants through programme audits and evaluations. The Code and the supporting Safety Guides are consistent with existing QA practices in Member States. However, certain differences exist, which are mainly expressed in the different QA functions assigned to the various organizations participating in the overall QA programme. Also, some Member States place more emphasis on redundant verification activities than on quality-achieving functions. Tendencies are also identified to grade the QA requirements in respect of items and activities, in accordance with some pre-established criteria. In an annex to the paper, QA practices in Member States participating in the Agency's Technical Review Committee on Quality Assurance (TRC-QA) are reviewed, indicating their similarities to and differences from the Code.

40799 **Quality assurance activities by the companies in the Mitsubishi group for nuclear power plants in Japan.** Fujiwara, K.; Moriyama, A. (Mitsubishi Heavy Industries Ltd., Tokyo (Japan)); Okabe, K. (Mitsubishi Electric Corp., Itami, Japan). pp 31-40 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

From International symposium on quality assurance for nuclear power plants; Paris, France (11 May 1981).

The paper summarizes the quality assurance (QA) activities of the Mitsubishi group regarding PWR plant construction. 1. To ensure a uniform approach to QA activities in the group, the Nuclear System Quality Assurance Administration Centre was established at the headquarters of Mitsubishi Heavy Industries. This Centre is engaged in establishing and promoting comprehensive QA plans, in supervising the interface control between the companies concerned, and in auditing each company's QA programme. 2. In parallel with endeavours to complete QA systems, a great effort has been made to instill consciousness of QA in everyone concerned with the work. It is emphasized that quality control (QC) circle activities play an important role in maintaining a high level of quality. An innovative system of design computerization coupled with model engineering is now being developed to improve design reliability and to prevent human error. Reliability improvement and preventive maintenance systems using computers are being introduced with the object of performing systematic corrective actions based on analyses of plant operation.

40800 **Quality assurance of nuclear power plants in Canada. The CSA N286 Standards.** Simmons, R.B.V.; Legg, G.G. (Atomic Energy of Canada Ltd., Engineering Co., Mississauga, Ontario). pp 55-66 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

From International symposium on quality assurance for nuclear power plants; Paris, France (11 May 1981).

The development of nuclear quality assurance (QA) standards in Canada as from 1971 resulted first in the CSA Z299 series for manufacturing. This left other nuclear plant activities without coverage. Therefore, in 1975 a committee was formed which was to prepare an all-embracing series of QA standards applicable to the owner and others throughout the lifetime of a nuclear power plant. The resulting CSA N286 series consists of: (a) CSA N286.0 - overall QA programme requirements for nuclear power plants, addressed to the owner; (b) separate standards covering each of the constituent phases: N286.1 - procurement QA; N286.2 - design QA; N286.3 - construction and installation QA; N286.4 - commissioning QA; N286.5 - operations QA; (c) Z299.1 to Z299.4 - manufacturing quality programmes - is considered to be integral with the N286 series for nuclear power plant QA. The development of these standards is based on QA defined as: "All those planned and systematic actions necessary to provide adequate confidence that a structure system or component will be satisfactory in service". The N286 standards are organized in two parts: 1. Management responsibilities and functions of the owner and each participating contractor; and 2. working-level functions, covering process, verfication and audit, and other functions appropriate to the phase covered by each standard. The paper describes the range of functions identified to provide a complete and practical QA programme. It discusses the standards for design QA and commissioning QA as examples of applications of the functions identified for different phases of the plant lifetime. The overall QA programme standard N286.0 is also discussed. Some comments are made on the relationship of the N286 series to other standards and on the background to the development of specific Canadian standards for QA.

40801 **CEGB approach to formalized quality assurance for the Heysham Stage-2 project.** Haire, T.P.; Fowler, J.L. (Central Electricity Generating Board, London (UK)). pp 67-77 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

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The CEGB currently has 18 operating reactors and 8 reactors being commissioned or under construction. During this period formal requirements for attaining satisfactory levels of quality have not been in force, but over the past 25 years CEGB has employed comprehensive and fully documented arrangements to ensure the necessary quality levels of safety-related items at every stage. This practice has formed an effective framework of control and includes many of the elements and activities of a formal quality assurance programme. The latest station in the CEGB's AGR programme is Heysham Stage 2 for which construction formally commenced with the pouring of concrete for the reactor foundations in September

1980. The site licence in existence for the Stage-1 reactors was modified to take account of the second phase and included a condition requiring the CEGB to make arrangements for quality assurance of the safety-related aspects of the plant from design through to operation. This was the first time that a formal requirement for quality assurance had been placed on the CEGB. The paper outlines the way in which the CEGB proposes to comply with these requirements. It also describes some of the existing CEGB procedures for attaining quality, including the technical and administrative arrangements, and concludes that these can form the basis of a more formal quality assurance procedure for the Heysham Stage-2 project.

40802 **Quality engineering programme in the design process. A major utility 's experience.** Christians, J.S.; Janik, Z.J. (Ontario Hydro, Toronto (Canada)). pp 79-92 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

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The paper describes the latest approach to quality engineering in the design process as applied by Ontario Hydro throughout the various phases of the project life cycle for Ontario Hydro generating stations and related facilities. Ontario Hydro has long recognized that the high quality and performance required in nuclear generating stations start in the design process and can best be achieved through an adequate and proper quality engineering programme in design. The current approach has evolved over a period of six years and represents a meaningful and effective series of requirements, functions and activities, which are used to ensure safety, reliability, economy and environmental acceptability of nuclear generating stations.

40803 **Selection of quality assurance programme levels for nuclear power plants. Present practice in Canada and future developments.** Thomas, R.A. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). pp 99-112 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

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According to the IAEA Code of Practice on the subject and also to numerous national standards, effective quality assurance (QA) for safety in nuclear power plants depends upon the application of a number of fundamental principles. One of these principles is that QA for systems, components and structures should be commensurate with the individual importance to safety of each item. Evidently, money spent on excessive QA may be partly or wholly wasted, while too little QA will provide insufficient confidence that an item will perform satisfactorily in service. To deal successfully with the requirement of 'importance to safety', a detailed methodology must be established, by means of which QA can be prescribed rationally and consistently. Set in the context of the Canadian nuclear power and nuclear standards programmes, two related methodologies which account for importance to safety as well as for some other specific factors have been developed and are in use. These related methodologies are applied to the manufacture and installation of safety-related items, and are based on the implementation of the fixed-step, graded standards of the Canadian Standards Association, CSA Z299. Information is presented on the main features of the methodologies and on Canadian nuclear power plant QA practice in general.

40804 **Selective application of quality assurance activities to nuclear power plant items and services.** Anderson, J.W. (Clinch River Breeder Reactor Plant Project Office, Oak Ridge, TN (USA)). pp 113-138 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

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The definition of quality assurance and the criteria for a quality assurance programme that are contained in both national and international codes and standards provide the principle of selective application of quality assurance activities for cost-effective results. The effective implementation of this principle requires a systematic and disciplined methodology that should be established by or for the owner at the beginning of a nuclear power plant project. The methodology that has proven to be successful generally includes a uniform method of classifying plant items and services at their lowest level of unit assembly and using that classification in the selection of applicable quality assurance activities and the specification of appropriate requirements for those activities. The applicable quality assurance activities are those to be implemented by the organizations designing, manufacturing, installing and operating plant items or performing support services. The methods and techniques provided illustrate the methodology and are one way by which a nuclear power plant project may translate the principle into application in order to achieve the desired results.

40805 **Quality assurance requirements for NSSS-equipment of a BWR-6, and quality levels in the stores of a manufacturer of primary-circuit nuclear components.** Gomez, E.; Alamo, P. (General Electric Technical Services Co. (GETSCO), Madrid, Spain); Perez, A.; Cue, G. (Equipos Nucleares S.A. (ENSA), Santander, Spain). pp 139-154 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982). (In Spanish)

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The first part of the paper describes the system used for determining the various levels of quality assurance for nuclear steam supply system (NSSS) equipment of the BWR-6 reactors which General Electric is now building in Spain. It also shows the procedure followed by the General Electric Technical Services Company (GETSCO) for the purchase and fabrication of equipment in Spain, paying due attention to the existing quality assurance requirements. The second part of the paper describes the instrumentation of the various quality assurance levels in the storage system of Equipos Nucleares, S.A. (ENSA), the Spanish manufacturer of the primary components of the NSSS.

40806 **Independent inspection agency as an instrument of quality assurance.** Sancho, J. (European Organization for Quality Control (EOQC), Electra del Viesgo, S.A., Santander, Spain); Cuallado, G. (Central Nuclear Valdecaballeros, Asociacion Espanola para el Control de la Calidad (AECC), Madrid). pp 215-229 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982). (In Spanish)

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The collaboration between Independent Inspection Agencies (IIA) and the regulatory body of a country in supervising the equipment and services directly related to the safety of its nuclear installations can be a valid solution, forming part of the system set up to guarantee satisfactory compliance with the safety parameters established for the purpose of avoiding damage to persons and property. In the light of the experience accumulated in recent years, the IIA in Spain is not a single body or a State body but may be chosen from among all legally established Inspection Agencies (IA). As described in detail in the paper, the IA is selected on the basis of an agreement between the owner of the facility and the supplier; it must present certain specific characteristics and is approved by the regulatory body. For a country with intermediate technological capacity and an industrial base sufficient to assimilate imported nuclear technologies, this participation of the IIA can result in significant advantages. On one side, the regulatory body exercising higher-level supervision of the work and of the units participating in the project, including of course the IIA, can reduce its allocation of personnel and of technical and material resources. On the other side, the IIA are also converted into an agency for the transfer of technology. The paper describes the principles governing their independence, structure, organization, internal control, external control, activities and scope of work. Similarly, the necessary criteria are laid down for the issue of reports and certificates, the handling of operational deviations, the system of appointing inspec-

tors and auditors, and the method by which they should be trained, evaluated and certified. Lastly, the paper shows how the non-nuclear part of the facility is supervised in Spain and describes the role which has been played by the country's industrial and professional associations.

40807 **Role of governmental authorities in the surveillance activities for quality assurance of nuclear power plants.** Koutsky, J.; Hrdlicka, Z. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)); Beranek, J.; Becvar, J. (Ceskoslovenska Komise pro Atomovou Energii, Prague); Herman, M. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). pp 231-240 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

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The paper deals with the legal and organizational aspects as well as with the principles and procedures of the quality assurance (QA) system for particular equipment of nuclear power plants in Czechoslovakia, and the role of governmental authorities in surveillance activities. The basic governmental document is the Decree No.5 (1979) of the Czechoslovak Atomic Energy Commission (CzAEC) on the QA of particular equipment in nuclear power plants with regard to nuclear safety. It is divided into ten sections: opening provisions; classification of the particular equipment; QA programmes; procedures of final elaboration of QA programme documentation; QA principles; QA during design; QA during manufacture, procurement, installation and commissioning; in-service inspection; QA during repair and modifications; and concluding provisions. Governmental surveillance is based on Governmental Resolution No.195 (1977). According to this resolution, inspection must be carried out by an organization which is independent of the manufacturing and operating organizations. This inspection is performed by the Czechoslovak Atomic Energy Commission (for nuclear safety) and by the Czech Safety Work Office and the Slovak Safety Work Office (for technical safety), together with subordinated regional divisions. The activities of these authorities are discussed.

40808 **Regulatory role in quality assurance - adversary or supportive.** Fiorelli, G. (Office of Inspection and Enforcement, United States Nuclear Regulatory Commission, Glen Ellyn, IL). pp 241-247 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

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The challenges of meeting the responsibilities regarding quality assurance during the design and construction of a nuclear power plant are considerable. While the aims of quality and safety are identical, the roles of the designer/constructor and the regulator in this endeavour differ. Proper objectives and programmes must be established, and management support on the part of the regulator is fundamental to the achievement of those objectives. The proper and professional execution of the responsibilities of the regulator can be extremely supportive in assuring project quality. One method that can be used by the regulator to focus attention on the quality of construction is through an inspection programme. Over many years of inspection experience in the United States of America, some fundamental and essential quality assurance/quality control reviews have been developed which should be included in a construction inspection programme. An attempt is made to provide insight into the proper interfacing between the regulator and constructor, especially where differences exist in approaches to quality, philosophies of management control and organizational incentives. The topics discussed are intended to assist in the development of inspection methods that should provide effective and substantial inspection coverage, even with limited regulatory resources.

40809 **Independent verification, operational phase. Liquid metal breeder reactors.** Bourne, P.B. (Hanford Engineering Development Lab., Richland, WA (USA)). pp 257-267 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

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The Fast Flux Test Facility (FFTF) recently achieved 100% power and is now in the initial stages of operation as a test reactor. As experimental fuels and materials are irradiated in the core, measurements of flux, temperature, pressure and flow will provide scientists with valuable data unavailable elsewhere. To ensure that these data are as free from operational anomalies as possible, an independent verification programme has been established in order to assist in maintaining stable plant conditions and to ensure safe operation of the reactor. Independent verification begins with the development of administrative procedures for controlling all other procedures and changes to the plant configurations. The technical content of the controlling procedures is subject to independent verification. The actual accomplishment of test procedures and operational manoeuvres is witnessed by personnel not responsible for operating the plant. Off-normal events are analysed, problem reports from other operating reactors are evaluated, and these results are used to improve on-line performance. Audits are performed to confirm compliance with established practices and to identify areas where individual performance can be improved. Experienced and trained engineers perform these independent verifications. Through responsible management and high-level technical performance, FFTF is expected to be the showplace of the liquid metal breeder reactor programme in the USA.

40810 **Economic aspects of quality assurance.** Pascual Mugica, A. (Iberduero, S.A., Bilbao, Spain). pp 297-308 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982). (In Spanish)

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The paper analyses the structure of the costs involved in quality assurance for nuclear projects. First, it gives a definition of quality costs and then it explains why an appropriate cost analysis is required. A breakdown of quality costs is given, distinguishing between internal and external costs. The costs of prevention, evaluation and internal losses are reviewed for the first case and those of external losses for the second case. The need for auditing quality costs in respect of both concept and function is reviewed. Lastly, as an example of the application of the above concepts, the paper reviews the actual costs incurred by an electric company for its quality assurance activities relating to the design, purchase, manufacture, construction, commissioning and operation of a 1000 MW(e) nuclear power plant.

40811 **Manpower requirements for quality assurance during various phases of a nuclear power plant.** Vessely, J.E. (Florida Power and Light Co., Miami (USA)). pp 313-324 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

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Guidelines based on experience in the United States of America are provided to assist in making decisions on quality assurance (QA) manpower requirements during the life cycle of a nuclear power plant. The major activities affecting QA manpower considerations during the life of a project or plant are: 1. project development, including site selection, contract review and vendor selection; 2. construction, including daily activities, major installations, testing and turnover; 3. operation, including daily activities, maintenance, fuel outages, major backfitting and plant modifications; and 4. decommissioning. In spite of all pre-planning measures taken, adjustments to the programme will have to be made as changes are indicated through system feedback and experience from other

sources and events, such as the Three Mile Island accident and the Brown's Ferry fire.

40812 **Manpower requirements for quality assurance of a nuclear power project in the Federal Republic of Germany.** Rumpf, H.G.; Huebner, W. (Technischer Ueberwachungs-Verein Bayern e.V., Muenchen (Germany, F.R.)); Link, M. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp 325-334 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

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The manpower requirements for Quality Assurance (QA) in the construction phase and partly during operation of a nuclear power plant in the Federal Republic of Germany are analysed. These requirements entail the availability of a sufficient number of personnel with the necessary qualifications for the different organizations involved in QA activities. The factors determining manpower requirements and the kind of work to be done are discussed. The number of QA persons required by the manufacturer, system supplier and authorized expert and their technical background and qualification level are discussed in detail.

40813 **Manpower requirements for quality assurance during operation.** Pratt, J.M.; Sollenberger, L.G. (Gilbert Associates, Inc., Reading, PA (USA)). pp 335-349 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

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As a result of the Three Mile Island accident and the findings presented in various investigatory reports, some fundamental changes are taking place in the role and scope of quality assurance. Recent changes to United States national codes, guides and standards are analysed in order to identify the principles involved. This analysis shows that the scope of the programme is being extended beyond the equipment designated 'nuclear safety related' and greater emphasis is being placed upon the independent verification of the satisfactory performance of activities affecting safety. Such fundamental changes could lead to a significant increase in the number of quality assurance personnel required to support an operating nuclear power plant. The evolving quality assurance organization at Three Mile Island is used to illustrate how these fundamental changes could affect the quality assurance organization and manpower requirements.

40814 **Requirements for, and training and certification of, quality assurance technicians for nuclear power plants.** Saiz, A. (Universidad Politecnica de Madrid, Spain); Mir, A.; Serrano, J. (Fuerzas Electricas de Cataluna, Barcelona, Spain). pp 375-388 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982). (In Spanish)

From International symposium on quality assurance for nuclear power plants; Paris, France (11 May 1981).

The paper examines the requirements for, and training and certification of, technicians working in a quality assurance department at periods when the site, the main supplier and the engineering firm are being selected for construction, commissioning and operation of a light-water nuclear power plant with an output of approximately 1000 MW(e). In determining the system to be applied for the present work, account is taken of the special fields of engineering, supply, commissioning and operation. To this end, an analysis is made of the necessary organization, pointing out the number of technicians in each of the phases mentioned, and the necessary experience and knowledge required for discharging the functions indicated and for obtaining the appropriate certification. The second generation of Spanish nuclear power stations - about 7500MW(e) - demonstrated the need for quality assurance technicians. The Spanish Atomic Forum, a member of Foratom, is the first Spanish body to deal with the problem of training of such technicians at the national level through holding of seminars. This led to the appearance (in April 1974) of the first publication in Spanish on these techniques, a document which is still being used for teaching purposes. Later, it was the university and the professional associations which, with the support of the State Administration, undertook to provide this instruction. The paper also analyses Spanish experience in the teaching of quality assurance techniques during the period 1975-80, describing the programmes and contents of the courses.

40815 **Quality assurance (QA) training at Westinghouse including innovative approaches for achieving an effective QA programme and establishing constructive interaction.** Chivers, J.H.; Scanga, B.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). pp 389-399 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

From International symposium on quality assurance for nuclear power plants; Paris, France (11 May 1981).

Experience of the Westinghouse Water Reactors Division with indoctrination and training of quality engineers includes training of personnel from Westinghouse divisions in the USA and overseas as well as of customers' personnel. A written plan is prepared for each trainee in order to fit the training to the individual's needs, and to cover the full range of information and activities. The trainee is also given work assignments, working closely with experienced quality engineers. He may prepare inspection plans and audit check lists, assist in the preparation of QA training modules, write procedures, and perform supplier surveillance and data analyses, or make special studies of operating systems. The trainee attends seminars and special courses on work-related technical subjects. Throughout the training period, emphasis is placed on inculcating an attitude of team work in the trainee so that the result of the training is the achievement of both quality and productivity. Certification is extended (given that education/experience/skill requirements are met) to such functions as mechanical equipment quality engineering, electrical equipment quality engineering, and start-up and testing quality engineering. A well-trained quality engineer is equipped to provide technical assistance to other disciplines and, through effective co-operation with others, contributes to the success of the organization's endeavours.

40816 **Qualification, certification and training systems of a Japanese nuclear power plant supplier.** Yoshijima, S.; Tomita, J.; Yoneda, Y. (Nuclear Energy Group, Toshiba, Corp., Tokyo, Japan). pp 401-407 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

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Training and indoctrination of personnel are very important for performing quality assurance activities in nuclear power plants. The paper presents policies, procedures and practices with regard to a training system for site construction workers, a training system for plant operation personnel at a special facility, and services and activities for operating plants. The training system for site workers and technicians offers basic training for all workers, and special training and qualification for field welders, cable-termination workers and non-destructive examination personnel. In addition to the qualification system for field welders applied by the regulatory body, a privat-company qualification system exists. Also, a training centre for BWR operators has been established. This facility has a simulator duplicating the main control room of an actual plant and a computer-assisted instruction system. Standard training courses, short-term basic courses, re-training courses, group training courses and special training courses are held at the training centre. Finally, the services and activities performed by Toshiba Corporation for operating plants are described. These activities of the plant supplier aim at keeping up and further enhancing the safety and reliability of operating plants and mainly consist of: (1) collection and evaluation of plant operation data, with re-evaluation and improvement of systems and components; (2) development of new maintenance techniques; (3) development of measures for reducing annual outage periods; and (4) plant emergency preparedness.

40817 **Quality assurance in developing countries, with particular reference to Indian experience.** Balaramamoorthy, K.; Rao, V.S.G.; Kulkarni, P.G. (Department of Atomic Energy, Bombay (India)). pp 413-428 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

From International symposium on quality assurance for nuclear power plants; Paris, France (11 May 1981).

The construction of nuclear power plants is one of the most advanced engineering activities. In India, nuclear power stations are designed, constructed, commissioned, operated and owned by the Department of Atomic Energy. Great emphasis has been put on achieving self-sufficiency in the various activities of the programme, including the manufacture of critical components, such as calandria, heat exchangers and steam generators, and structural components like Zircaloy calandria tubes, pressure tubes and fuel bundles. But like all pioneering ventures this development is not without its problems, costs and delays. In developing countries, local industrial participation is not only desirable but sometimes indispensable and essential. Establishing a nuclear programme very often symbolizes the introduction of modern science and technology, both fundamentally and as applied. To be fully effective, quality assurance (QA) must be comprehensive and cover all engineering activities, including design, procurement, manufacture, construction, commissioning and operation. In the Indian nuclear power programme, well-established and proven QA procedures and practices are being followed during the various stages of nuclear power plant construction and operation. Since training of scientific and technical manpower is an important activity in a developing country, a manpower training programme was initiated in India several years before the introduction of nuclear power plants. The paper deals in detail with the practices of establishing and implementing QA over the years, including training of requisite manpower, problems faced and how they were resolved through progressive indigenization in the manufacture of components, and in construction and operation of nuclear power plants.

40818 **Qualification, certification and training of quality assurance personnel.** Ribeiro da Costa, J. (NUCLEBRAS, Rio de Janeiro (Brazil)). pp 429-453 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

From International symposium on quality assurance for nuclear power plants; Paris, France (11 May 1981).

The qualification and certification of technical personnel for activities related to nuclear quality is one of the most critical problems in developing countries which use nuclear power for peaceful purposes. A careful analysis of industrial quality levels is required in order to determine existing weaknesses, to correct deviations and to regulate quality-related activities so that nuclear power programmes can be implemented with no difficulties other than those inherent in the very complexity of nuclear technology. In this connection, indoctrination, training and qualification of technical personnel, in line with the requirements to quality assurance (QA), are tasks which must be undertaken right at the outset, taking into account the country's stage of technological development, its objectives and the necessity to increase its direct participation in QA activities in the shortest possible time. The paper shows how the problem was approached in Brazil, beginning with an analysis of the situation of industry in this field, the evolution of QA training programmes through several stages, leading to systematic training in the field of nuclear quality and, finally, the introduction of training in the more specific and sophisticated field of nuclear reliability.

40819 **Quality assurance in Spain and its transfer to nuclear projects in Latin America.** Alvarez de Buergo, L.; Montes, L. (Junta de Energia Nuclear, Madrid (Spain)); Santamaria, J.L. (Central Nuclear de Regodola, La Coruna, Spain). pp 455-464 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982). (In Spanish)

From International symposium on quality assurance for nuclear power plants; Paris, France (11 May 1981).

The Spanish nuclear programme is included in the National Energy Plan approved by parliament in 1979. It is anticipated that there will be some 11,000MW(e) of installed power around 1987. The programme is intended to ensure the availability of sources for coping with the demand for electric power and at the same time to increase national participation through the transfer of technology. In the first generation of Spanish nuclear power plants, built between 1964 and 1972 (one PWR, one BWR and one GCR), national participation in terms of value added was less than 30%. The contribution of engineering and industry was modest, with few incentives because of the diversity of the plants. The second generation consists of seven units (six PWRs and one BWR) which are in an advanced stage of construction. National participation has been extensive, exceeding 60% in real terms. Quality assurance has been the decisive instrument in the assimilation of technology, since it was a process of learning by doing, i.e. knowledge was obtained in the fabrication of goods and the performance of services of proven quality, which presupposed a multiplying factor in development. The transfer of technology achieved is the result of several concurrent circumstances, such as the creation of incentives on the part of the Government or the willingness of the supplier to make the technology available. But what is needed above all is the development in industry of a mental attitude geared to the restructuring of organizational systems and to the acquisition of the necessary equipment. For all this, however, there is a lack of training. The efforts made in this direction have been extensive and useful experience has been gained; this is being transmitted to various countries which have sent over 200 engineers to Spain.

40820 **Effects of flow dispersers upstream of two-phase flow monitoring instruments.** Sheppard, J.D.; Thomas, D.G.; Tong, L.S. (Oak Ridge National Lab., TN). *International Journal of Multiphase Flow;* 8: No. 1, 59-70(1982). Contract W-7405-ENG-26.

The effects of flow dispersing screens on the accuracy of two-phase flow monitoring instruments was studied with an air-water two-phase flow loop in which air and water flow rates were monitored separately. Flow dispersers were installed at the inlet of an instrumeted spool piece containing a drag disk and a turbine meter. For the present tests, the spool piece was mounted vertically and flow was always down. When the turbine was upstream of the drag disk, two-phase mass flow rates indicated by the instruments were approximately one-third actual mass flows both in the presence and absence of flow dispersers. However, when the drag disk was upstream of the turbine, the use of flow dispersing screens upstream of the drag disk resulted in flow measurements within +10% of actual flow rates over the range 0-160kg/m^2.s.

40821 **(PB—82-105396) Quick look report on LOBI test A1-04.** Piplies, L. (Commission of the European Communities, Luxembourg). [nd]. 43p. NTIS PC E03/MF E03.

LOBI (loop blowdown investigations) is a 1/700 scale model of a 1300 MWe PWR. It has two primary cooling loops, one of which is intact, the other having a nozzle with which a break or fracture can be simulated. Each loop has its own pump so that the mass flows may differ. Heat from nuclear fuel is mimicked by an array of 64 electrically heated rods. For the A1 - 04 test the 'break' was in the cold leg between the primary pump and the reactor vessel model. A table shows the flow conditions prior to the break and graphs show pump speeds, lower plenum pressures, mass flows, differential pressures, fluid densities and distribution of core temperature after the break. Positioning of the instrumentation throughout the model is indicated by a coding system.

25 ENERGY STORAGE

40822 **Energy storage for electric utilities.** Mawardi, O.K. (Case Western Reserve Univ., Cleveland, OH). pp 687-732 of Alternative energy sources. Part B. Manassah, J.T. (ed.). New York, NY; Academic Press (1981).

From Symposium on alternative energy sources; Kuwait, Kuwait (1 Feb 1980).

The state of the art of energy storage systems used by the electric utilities for peak shaving is discussed. The underlying concepts for the operation of the most important available schemes

have been described. Whenever applicable the economics of the energy storage schemes as well as the cost expressed in $/kW of electric capacity have been provided. In addition, the procedure used in modeling an energy storage system for planning purposes has been explained. The paper concludes with a prediction of the trend expected in future expansions of electric power plants.

2501 Magnetic

40823 **(LA—9208-PR) Superconducting magnetic energy storage (SMES) program, January 1-December 31, 1981.** Rogers, J.D. (comp.). (Los Alamos National Lab., NM (USA)). Feb 1982. Contract W-7405-ENG-36. 32p. NTIS, PC A03/MF A01. Order Number DE82009083.

Work reported is on the development of a 30 MJ superconducting magnetic energy storage (SMES) unit for use by the Bonneville Power Administration (BPA) to stabilize power oscillations on their Pacific AC Intertie. The 30 MJ superconducting coil manufacture was completed. Design of the seismic mounting of the coil to the nonconducting dewar lid and a concrete foundation is complete. The superconducting application VAR (SAVAR) control study indicated a low economic advantage and the SAVAR program was terminated. An economic and technological evaluation of superconducting fault current limiter (SFCL) was completed and the results are reported.

2502 Compressed Gas

REFER ALSO TO CITATION(S) 40825

40824 **(PNL-SA—7648) Physical and chemical stability of Galesville Sandstone at elevated temperatures and pressures.** Stottlemyre, J.A.; Erikson, R.L.; Smith, R.P. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1979. Contract AC06-76RL01830. 25p. (CONF-790803—66). NTIS, PC A02/MF A01. Order Number DE82008593.

From 14. intersociety energy conversion conference; Boston, MA, USA (5 Aug 1979).

Galesville Sandstone is currently being considered as a candidate lithology for a Compressed Air Energy Storage (CAES) demonstration facility. This paper summarizes the results of a preliminary set of laboratory-scale autoclave experiments on a sample of the Galesville from the Media natural gas storage field in Illinois. The dependent variables of interest are percent changes in air permeability, liquid water permeability, and friability (disaggregation potential). The independent variables include temperature (50 to 300°C), pressure (60 to 120 bars), time (0.5 to 2.0 months), oxygen content (0 to 21%), carbon dioxide content (0.0 to 0.1%), autoclave type, autoclave stirring frequency, and the humidity conditions. Three humidity conditions were simulated: (1) dry air only, (2) air and water vapor, and (3) liquid water only. Temperature, humidity and time were the dominant variables. Apparently, solutioning of silica and carbonate cements attributes markedly to the observed increases in friability and permeability for cores treated at elevated temperature in a liquid and/or vapor environment. The lack of confining pressure may also be a significant factor. The average change for air and liquid permeabilities was approximately 30 +- 10% for all conditions tested. The average increase in the friability index was 150%.

2503 Pumped Hydro

40825 **(EPRI-EA—2231) Integrated environmental and safety assessment of selected mechanical energy storage systems. Final report.** (Acres American, Inc., Buffalo, NY; NUS Corp., Rockville, MD (USA)). Jan 1982. 315p. NTIS, PC A14/MF A01. Order Number DE82902073.

The environmental, safety, and social impacts of two mechanical storage systems, underground pumped hydro (UPH) and compressed air energy storage (CAES) are similar to those of existing peaking power plants. These impacts, with engineering factors, form a methodology for selecting sites for these two systems. Application of this methodology to a hypothetical case indicates that, although design alternatives which mitigate adverse environmental impacts are recommended, site selection effectively limits the environmental effect of CAES or UPH plants. Public perception of CAES and UPH energy storage facilities should generally be positive, provided that those affected are informed and allowed to participate in the siting process.

2505 Flywheels

REFER ALSO TO CITATION(S) 40702, 40922

2506 Thermal

REFER ALSO TO CITATION(S) 40354, 40645, 40646, 40647

40826 **(EUR—6936-DE) Investigation and development of systems for the storage of thermal energy in the temperature range between -25°C and +150°C.** Eckerlin, P.; Klopfer, A.; Schroeder, J. (Philips Forschungslaboratorium G.m.b.H., Aachen (Germany, F.R.)). 1980. 164p. (In German). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

The investigation of materials presumably suitable as storage media for latent heat have indicated that water, some salt hydrates and eutectic mixtures of water and salt hydrates are suitable for storing low-grade heat in residential energy systems. About 30 of these have been shown experimentally to have the quality requirements for the practical application in storage units. The suitable media with all relevant properties investigated are given. A theoretical study of the possibilities of storing low-grade heat by means of reversible chemical reactions was carried out. On the basis of thermodynamic considerations, criteria are discussed for the selection of suitable reactions. From more than 30 systems investigated, all but one (i.e., H_3O liquid/dehydrated salt) are based on gas/solid and gas/liquid interactions. In addition, chemical heat pump systems, using heat from environmental air or soil, were included. The highest energy density of a storage unit can be obtained with systems working as a chemical heat pump taking heat from the soil. For some chemical systems having high storage densities, the volumes of the substances needed for a storage capacity oz 1 MWh and the corresponding temperatures at which the heat can be released are given.

40827 **(EUR—7065-DE) Investigation of medium- and high-temperature latent heat storage materials.** Heine, D.; Heess, F.; Steiner, D. (Institut fuer Kerntechnik und Energiewandlung e.V., Stuttgart (Germany, F.R.)). 1981. 115p. (In German). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

Experimental investigations were carried out on the long-term behavior of latent heat storage materials for use in the temperature ranges 200 to 450°C and 700 to 900°C. These investigations comprised the corrsion of structural materials together with promising storage materials and the thermal stability and the melting and freezing behavior of these storage materials. From the corrosion tests, the mass loss of sheet metal samples was measured and thickness reduction and corrosion rate were calculated. Furthermore, the corrosion type was determined using optical and scanning electron microscopes. During cyclic tests, melting and freezing curves were continually measured. The thermal stability of the storage materials as a function of melting and freezing was determined. The combinations mild steel with $NaNO_3$, boiler steel with KCl-$ZnCl_2$, $NaNO_3$ and $MgCl_2$-NaCl and NiCu30Fe with KCl-$ZnCl_2$ are compatible (temperature range 200 to 450°C). In the temperature range 700 to 900°C the structural materials are badly corroded.

40828 **(PB—81-852774) Thermal energy storage: Glauber's salt. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 65p. NTIS PC N01/MF N01.

Systems and techniques are described for the use of Glauber's salt (sodium sulfate decahydrate) as a medium for thermal storage. These systems are used for heating and/or cooling in conjunction with solar energy conversion during off-peak demands for energy. (Contains 54 citations, fully indexed and including a table of contents.)

40829 **(PB—81-853988) Computer analysis applied to energy storage and energy utilization. January 1970-November 1980 (citations from the NTIS Data Base). Report for January 1970-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 145p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning computerized simulations and mathematical modeling and computer programs and calculations applied to energy storage, and energy utilization designs, techniques, media, equipment, and systems for a wide variety of energy sources, i.e., wind, flywheels, and electric generators, but chiefly solar sources. (Contains 115 citations, fully indexed and including a table of contents.)

40830 **(PB—81-853996) Computer analysis applied to energy storage and energy utilization. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 168p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning computerized simulations and mathematical modeling and computer programs and calculations applied to energy storage and energy utilization designs, techniques, media, equipment, and systems for a wide variety of energy sources, i.e., wind, flywheels, and electric generators, but chiefly solar sources. (Contains 147 citations, fully indexed and including a table of contents.)

40831 **(PB—81-854002) Computer analysis applied to energy storage and energy utilization. January 1970-November 1980 (citations from the Engineering Index Data Base). Report for January 1970-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 127p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning computerized simulations and mathematical modeling and computer programs and calculations applied to energy storage, and energy utilization designs, techniques, media, equipment, and systems for a wide variety of energy sources; solar, wind, flywheels, and electric generators. There is considerable consideration of applications to specific geographic locations also. (Contains 120 citations, fully indexed and including a table of contents.)

40832 **(PB—81-854010) Computer analysis applied to energy storage and energy utilization. January 1972-November 1980 (citations from the International Aerospace Abstracts Data Base). Report for January 1972-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 157p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning computerized simulations and mathematical modeling and computer programs and calculations applied to energy storage, and energy utilization designs, techniques, media, equipment, and systems for a wide variety of energy sources, i.e., wind, flywheels, and electric generators, but chiefly solar sources. (Contains 147 citations, fully indexed and including a table of contents.)

40833 **(SAND—81-8191) Effects on soils from hot-storage tanks. Technical report.** (Ko (Kenneth C.) and Associates, Inc., Denver, CO (USA)). Mar 1982. Contract AC04-76DP00789. 148p. NTIS, PC A07/MF A01. Order Number DE82009843.

Portions of document are illegible.

The characteristics of foundation soils normally encountered in the continental United States were investigated with respect to reactions at elevated temperatures in accordance to Contract No. SNLL-84-1173. Two soils models, a sand soil and a more clayey soil, were developed as being representative of most foundation conditions. Temperature of hot tanks under consideration for the use of solar energy storage range from 200°C to 816°C. The behavior of foundation soils under such high temperatures would dictate the design specifications of foundations for direct support of the storage tanks. The effects of the hot tank upon the two soil models were analyzed in terms of soil structure, soil/tank interaction and environmental problems in the case of spillage of the hot liquids.

2509 Batteries

REFER ALSO TO CITATION(S) 40921

40834 **(AD-A—097739/7) Specular lithium deposits from lithium hexafluoroarsenate/diethyl ether electrolytes. Technical report.** Koch, V.R.; Goldman, J.L.; Mattos, C.J.; Mulvaney, M. (EIC Labs., Inc., Newton, MA (USA)). Apr 1981. 25p. NTIS PC A02/MF A01.

A new class of aprotic organic electrolytes in which to cycle the lithium electrode has been developed. Blends of diethyl ether (DEE) and tetrahydrofuran (THF) incorporating $LiAsF_6$ have been found to afford Li electrode cycling efficiencies in excess of 98%. In addition, specular deposits of up to 10 C per sq cm may be plated from these systems. The kinetic stability of these blended electrolytes toward Li is thought to be due to the formation of a protective lithium ethoxide film.

40835 **(AD-A—097822/1) The relation of batteries to explosives. Technical report.** Freeman, C. (Naval Surface Weapons Center, Silver Spring, MD (USA)). Sep 1980. 23p. NTIS PC A02/MF A01.

All batteries contain chemical materials which can be made to explode under certain conditions. This report defines applicable explosives terminology and discusses these definitions in terms of explosives, thermal runaway and fires associated with aqueous (Le Clanche, mercury, lead acid, nickel cadmium) and non-aqueous (lithium anode systems) batteries.

40836 **(AD-A—097834/6) Composites for electrochemical technology. Part I. Survey of electrode corrosion studies for lead-acid batteries. Technical report.** Angres, I.A.; Sutula, R.A. (Naval Surface Weapons Center, Silver Spring, MD (USA)). Sep 1980. 24p. NTIS PC A02/MF A01.

Corrosion methods used to screen lead electrodes which are potential candidates for use in lead-acid submarine batteries are discussed.

40837 **(AD-A—102774/7) Transient techniques for battery impedance measurements, small amplitude exponential perturbation technique. Technical report.** Zimmerman, A.H.; Janecki, M.C. (Aerospace Corp., El Segundo, CA (USA). Chemistry and Physics Lab.). 1 Jul 1981. 27p. NTIS, PC A03/MF A01.

A perturbation technique is reported for measuring the impedance of battery cells under conditions of controlled potential. The small amplitude exponential perturbation (SAEP) technique is applicable over an extremely wide frequency range and appears to be the method of choice for measuring the impedance of battery cells that contain very little stored electrochemical energy.

40838 **(EUR—7071-FR) Solid fluoride electrolytes.** Lucas, J.; Poulain, M.; Poulain, M.; Matecki, M.; Pannetier, J. (Rennes-1 Univ., 35 (France)). 1981. 43p. (In French). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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This research programme is directed to the optimization of three kinds of solid fluorides which could be used as solid electrolytes. The three kinds of fluoride materials which were systematically investigated were: a molecular solid, stannous fluoride SnF_2; non-stoichiometric fluorides MF/sub 3+x/; and fluorzirconate glasses. Structural studies on SnF_2 show unambiguously a molecular character. Preliminary measurements of F^- mobility by NMR spectroscopy and ionic conductivity show that this material is in the range of the best F^- conductors presently known. Investigations on many ZrF_4-oxides or ZrF_4-fluorides systems led to the

conclusion that it is possible to stabilize a non-stoichiometric cubic form of ZrF_4. A neutron diffraction study shows the existence of fluoride vacancies coupled with the presence of F-F pairs. This situation is theorically good to observe F diffusion. Fluorozirconate glasses show a strong resistance to corrosion by fluorinated reagents. Preliminary studies in collaboration with Professor DESPORTES, Unversity of Grenoble, show that they are good candidate for batteries application because of the good mobility of F^- and easy preparations and handling.

40839 **(EUR—7072-DE) High energy galvanic cell with molten electrolyte.** Borger, W.; Kappus, W.; Kunze, D.; Laig-Hoerstebrock, H.; Panesar, H.; Sterr, G. (Varta Batterie A.G., Hannover (Germany, F.R.)). 1981. 227p. (In German). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Portions of document are illegible.

Research on the design, fabrication, and performance testing of lithium-sulfur batteries for electric vehicle propulsion is described in detail. (WHK)

40840 **(NASA-CASE-LEW—13286-1) Additive for zinc electrodes.** Soltis, D.G.; Sheibley, D.W.; Nagle, W.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jun 1981. 7p. NTIS PC A02/MF A01.

An improved zinc electrode for alkaline cells includes up to about ten percent by weight of Ba(OH)2.8H2O with about five percent being preferred. The zinc electrode may or may not be amalgamated with mercury.

40841 **(NASA-CASE-LEW—13556-1) Polyvinyl alcohol battery separator containing inert filler.** Sheibley, D.W.; Hsu, L.C.; Manzo, M.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jun 1981. 14p. NTIS PC A02/MF A01.

A cross-linked polyvinyl alcohol battery separator is disclosed. A particulate filler, inert to alkaline electrolyte of an alkaline battery, is incorporated in the separator in an amount of 1-20% by weight, based on the weight of the polyvinyl alcohol, and is dispersed throughout the product. Incorporation of the filler enhences performance and increases cycle life of alkaline batteries when compared with batteries containing a similar separator not containing filler. Suitable fillers include titanates, silicates, zirconates, aluminates, wood floor, lignin, and titania. Particle size is not greater than about 50 microns.

40842 **(NASA-CR—166686) Cycle life test of secondary spacecraft cells.** Harkness, J.D. (Naval Weapons Support Center, Crane, IN (USA)). Apr 1980. 293p. NTIS PC A13/MF A01.

The results of the life cycling program on rechargeable calls are reported. Information on required data, the use of which the data will be put, application details, including orbital description, charge control methods, load rquirements, etc., are given. Cycle tests were performed on 660 sealed, nickel cadmium cells. The cells consisted of seven sample classifications ranging form 3.0 to 20 amp. hours. Nickel cadmium, silver cadmium, and silver zinc sealed cells, excluding synchronous orbit and accelerated test packs were added. The capacities of the nickel cadmium cells, the silver cadmium and the silver zinc cells differed in range of amp hrs. The cells were cycled under different load, charge control, and temperature conditions. All cell packs are recharged by use of a pack voltage limit. All charging is constant current until the voltage limit is reached.

40843 **(NASA-TM—82724) Performance of advanced chromium electrodes for the NASA redox energy storage system. Final report.** Gahn, R.F.; Charleston, J.; Ling, J.S.; Reid, M.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Nov 1981. 23p. NTIS, PC A02/MF A01.

Chromium electrodes were prepared for the NASA Redox Storage System with meet the performance requirements for solar-photovoltaic, wind-turbine and electric utility applications. Gold-lead catalyzed carbon felt electrodes up tp 930 sq cm were fabricated and tested in single cells and multicell stacks for hydrogen evolution, coulombic efficiency, catalyst stability and electrochemical activity. Factors which affect the overall performance of a particular electrode include the carbon felt lot, the cleaning treatment and the gold catalyzation method. Effects of the chromium solution chemistry and impurities on charge/discharge performance are also presented.

40844 **(NASA-TM—83814) Electrochemical models for the discharge characteristics of the nickel cadmium cell.** Spritzer, M.S. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Aug 1981. 19p. NTIS, PC A02/MF A01.

The potential time characteristics of a preconditioned fully charged cell discharge at constant current was studied. Electrochemical principles applied to the sealed nickel cadmium cell and its behavior and to predict operating characteristics were described. A thermodynamic approach to arrive at several related but different equations and its discharge are reported.

40845 **Electrode for electrochemical cell.** Kaun, T.D.; Miller, W.E.; Nelson, P.A. (to Department of Energy). US Patent 4,306,004. 15 Dec 1981. Filed date 9 May 1980. vp. PAT-APPL-148312.

An electrode structure for a secondary electrochemical cell includes an outer enclosure defining a compartment containing electrochemical active material. The enclosure includes a rigid electrically conductive metal sheet with perforated openings over major side surfaces. The enclosure can be assembled as first and second trays each with a rigid sheet of perforated electrically conductive metal at major side surfaces and normally extending flanges at parametric margins. The trays can be pressed together with moldable active material between the two to form an expandable electrode. A plurality of positive and negative electrodes thus formed are arranged in an alternating array with porous frangible interelectrode separators within the housing of the secondary electrochemical cell.

40846 **Improved electrolyte for lithium-thionyl chloride battery.** Shipman, W.H.; McCartney, J.F. US Patent Application 217,269. 17 Dec 1980. 10p.

A lithium, thionyl chloride battery is provided with an electrolyte which makes it safe under a reverse voltage condition. The electrolyte is niobium pentachloride which is dissolved in the thionyl chloride.

29 ENERGY PLANNING AND POLICY

40847 **(NASA-SP—7043(30)) Energy: a continuing bibliography with indexes.** (National Aeronautics and Space Administration, Washington, DC (USA)). Jul 1981. 461p. NTIS PC$15.00.

This bibliography lists 1546 reports, articles, and other documents introduced into the NASA scientific and technical information system from April 1, 1981 through June 30, 1981.

40848 **Overview of energy resources.** Dellon, A.L. (Nielsen, Wuerster and Associates, New York, NY). pp 149-150 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 40857, 40881, 40882, 40883, 40884, 40885, 40886, 40887, 40964, 40971

40849 **(EUR—6779/2-EN) Energy data handbook (Damocles). Part I. Definitions and instructions (Sections 15-18).** Heirwegh, T.; Jadot, P. (Systems-Europe S.A., Brussels (Belgium)). 1980. 144p. European Community information Service, 2100 M Street, NW, Suite 707, Washington, DC 20037.

This portion of the handbook gives process variables, process definitions and classification, definitions of units and instructions for use, input forms and entry instructions, and glossary and codes.

40850 **(EUR—6779/111-EN) Energy data handbook (Damocles). Part II: descriptions.** Heirwegh, T.; Jadot, P.; Finon, D. (Systems-Europe S.A., Brussels (Belgium)). 1980. 88p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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Descriptions of subsystem's and processes in the present state of the model are presented. Symbolic (graphs) representation of the TRESS network and the MERES network: imports (exports) is included. A description of the coal and oil supply subsystems and the subsystem's processes is given.

40851 **(EUR—6781-EN) Energy and resources modelling. Final report.** (Queen Mary Coll. Industrial Research Ltd., London (UK)). 1980. 191p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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A technical and a users manual for the Polynational Polyperiod (PNPP) Energy Flow Optimization Model under development using the Queen Mary College Generic LP Modelling System is presented. The technical manual provides a guide to the model structure which has been established and to the associated ceiling for the generic LP matrix. This is followed by a detailed description of the United Kingdom national model (UK 5P) which is the next stage to the realization of the aggregated PNPP model. An example of the model results is given by the reference case studies which examine the effects of a range of economic growth rates on the exploitation of energy resources. The users manual defines the basic rules for building generic models. The procedure for running models is given in detail with the aid of a simple example problem. Advance features developed for PNPP problems are described.

40852 **(EUR—7288-EN) Prototype EFOM 12D PNPP model. Final report.** Clifford, J.S.; Slee, P.V. (Queen Mary Coll. Industrial Research Ltd., London (UK)). 1981. 91p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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A structure was established for running Polynational Polyperiod (PNPP) 12D Energy Flow Optimization Models (EFOM). A Protype 8 country 5 time period model (8N5P) was run successfully, with economical use of computer time. The stages of development of the model structure are outlined. A complete description of data (technological, cost, import/export options, supply and demand, and initial capacities) is given.

40853 **(EUR—7289-EN) Energy models of European Communities: implementation and methodological tests in Italy. Final report.** (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). 1981. 53p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The results of a set of methodological tests, together with the results of activities carried out for software implementation, new software development, data base validation, and for a preliminary involvement of potential public and private users in Italy are described. The strategy that has been adopted to obtain a meaningful involvement of Italian users, both in the first stage of energy models implementation, and in a longer range utilization is described. Results, difficulties, problems to be solved, and possible solutions are briefly indicated. The data validation is discussed. Some details on software implementation and new developed features are described; the main changes introduced are related to the construction of an interactive users friendly language. The methodological tests carried out on the models are described and a reference case study is defined. The model reactions were tested and some sensitivity analysis was performed.

40854 **(EUR—7332-EN) Preliminary case studies of economy and energy profiles for Ireland during 1979-1990. Final report.** Henry, E.W. (Economic and Social Research Inst., Dublin (Ireland)). 1981. 86p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

How Irish 1985 Energy Demand Model (EDM) case study results have been optimized on the supply side, by means of the EFOM model and software, are described. The 1985 case study results are for low, likely, and high cases. The Low case represents a 1985 Irish economic profile for real GNP being 54% greater thand the GNP of 1974. The Likely case relates to 1985 real GNP being 70% greater than that of 1974, and the High to real GNP being 92% greater. The 1985 final energy results emerging from the case studies are tabulated, showing quantities of final energy required by each of the 13 sectors of the Irish EDM. In all three case studies, 5 of the 13 demand sectors take in aggregate more than 76% of the total energy; these five sectors, in decreasing size of demand, are: other household uses; other industries; private transport; cement; other services. The preparation for EFOM is described. The optimal final energy flows, with some comparisons with the non-optimal inital flows, are considered. The gross primary energy quantity and cost underlying the optimal final energy flows are examined in detail.

40855 **(EUR—7391-EN) EFOM 12C software: general overview. Final report.** Jadot, P.; Fuchsova, J.; Vankelecom, E.; Van der Voort, E.; Thonet, C. (Systems-Europe S.A., Brussels (Belgium); Commission of the European Communities, Brussels (Belgium). Directorate General for Research, Science and Education). 1981. 129p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

A logic manual defining the general philosophy of the EC-12C software is presented. The guidelines used to develop the Energy Data Base and the programs of the energy flow models are: within the frame of some basic conventions, the data base structure and software should be as independent as possible from the energy system representation; utilization of the models should be user-friendly; as data has to be collected and manipulated by various national expert teams, extensive data consistency checks and appropriate error messages should be included in the software to support the data validation process; the various energy flow models should be integrated; the outputs of the programs should be user-controlled; and the scope of the study is under user's control. As a result of those guidelines, an integrated set of software composed of DAMOCLES (Data Base Management System); SIML (simulation program suitable for data analysis and description study); and ORESTE EDISON (LP matrix generator and report writer) was developed. These are described.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 41432

40856 **(EMD—82-13) Mitigating socio-economic impacts of energy development.** (General Accounting Office, Washington, DC (USA)). 2 Mar 1982. 81p. General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

This study provides information on energy resource development and the efforts of State and local communities in the Rocky Mountain, Appalachian, and coastal regions to deal with the related social and economic impacts. It also provides information on the range of options and resources generally available to States and local communities from local, State, industry, and Federal sources to plan for and mitigate the adverse effects of energy development. Onsite visits and interviews with State, local, and Federal officials and private industry involved in mitigating socioeconomic impacts were made.

40857 **(EUR—7285-EN) EC energy modelling programme. Final report. Final report.** Brascamp, M.H. (Nijverheidsorganisatie TNO, Apeldoorn (Netherlands). Div. of Technology for Society). 1981. 59p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The scope of the work was the implementation of the EXPLOR-EDM model for the Netherlands. A schematic overview of the different steps in the implementation process is given. Progress is reported on the implementation of the model. EXPLOR is an interindustrial econometric model to describe the sectorial behavior in the economy under exogenous given macro-economic conditions. The EDM model relates the sector activities in EXPLOR to energy damand. How the selection of relevant structure and exogenous parameters takes place and how this selection procedure interplays with the scenario generation are described. (MCW)

40858 **(NP—2903939) Empirical investigation of optimal severance taxation in Alabama. Volume II.** Leathers, C.G.; Zumpano, L.V. (Alabama Univ., University (USA). School of Mines and Energy Development). Oct 1980. 47p. School of Mines and Energy Development, Univ. of Alabama.

The research develops a theoretical and empirical foundation for the analysis of severance taxation in Alabama. Primary emphasis was directed to delineating an optimal severance tax structure for the state of Alabama and, in the process, assess the economic and fiscal consequences of current severance tax usage. The legal and economic basis and justification for severance taxation, the amounts and distribution of severance tax revenues currently generated, the administration of the tax, and severance tax practices prevailing in other states were compared in Volume I. These data, findings, and quantitative analyses were used to ascertain the fiscal and economic effects of changes in the structure and utilization of severance taxation in Alabama. The actual and potential productivity of severance taxation in Alamama is discussed. The analysis estimates the state's severance tax revenue capacity relative to the nation and to regional neighbors. The analysis is followed by an intrastate fiscal examination of the state and local tax system. In the process, the relative revenue contribution of severance taxes to state and local revenues is quantified, as well as comparing the revenue capacity and utilization of severance taxes to other state and local levies. An examination is made of the question of who actually pays the severance taxes by an analysis of the shifting and incidence characteristics of taxes on natural resources. Serious doubt is raised that states can, under normal economic circumstances, export a large portion of the severance tax burden to out-of-state users. According to the analytical results of the study, profit margins will be affected; therefore, higher severance taxes should only be imposed after rational assessment of the consequences on business incentives and employment in the extractive inudstries, especially coal.

40859 **(PB—81-199614) Industrial development in the TVA area during 1980. Annual report.** (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Use and Distributor Relations). Mar 1981. 39p. NTIS, PC A03/MF A01.

The report contains information on new and expanding industrial plant activities in the TVA area announced during calendar year 21980. The information was obtained from local, state, and national publications and from development agencies, industrial development association, distributors of TVA power, and various TVA units. Summaries of increased kilowatt demands, investment, and employment by major industry groups are provided in this report for the entire TVA area, as well as for each of the seven districts of the area. In addition to the reported data, statistically estimated values are included in the summaries for cases where data were either partially or completely unreported.

40860 **(PB—81-230575) Energy and development: extended analysis and implications.** Leigh, J.G.; Strasser, J.V.; Trehan, R.K. (Mitre Corp., McLean, VA (USA); Agency for International Development, Washington, DC (USA)). May 1980. 200p. (MTR—80W57). NTIS, PC A09/MF A01.

This report describes the results of further analyses of the relationships between energy and indicators of economic and social development in Less Developed Countries. Policy implications for energy development assistance are drawn. This work is a continuing part of a broader effort to provide analytical support for policy development in the energy assistance programs of USAID. This report is a companion volume to the preliminary analysis previously published.

40861 **(PB—81-231540) Energy and development in Central America. Volume I: Regional assessment. Final report October 1979-February 1980.** Park, W.; Neves, C.; Trehan, R.; Ackerman, E.; Gallagher, W. (Mitre Corp., McLean, VA (USA). METREK Div.; Agency for International Development, Washington, DC (USA)). Feb 1980. 128p. (MTR—80W601). NTIS, PC A07/MF A01.

This report presents an energy assessment of six Central American countries - Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama - to assist these countries in defining, planning, and meeting energy requirements implicit in their economic and social development goals and also to assist the U.S. Agency for International Development and other development organizations in defining energy programs in Central America.

40862 **(PB—81-231557) Energy and development in Central America. Volume II: Country assessments. Final report October 1979-February 1980.** Park, W.; Neves, C.; Trehan, R.; Ackerman, E.; Gallagher, W. (Mitre Corp., McLean, VA (USA). METREK Div.; Agency for International Development, Washington, DC (USA)). Mar 1980. 350p. (MTR—80W602). NTIS, PC A15/MF A01.

This report presents an energy assessment of six Central American countries - Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama - to assist these countries in defining, planning, and meeting energy requirements implicit in their economic and social development goals and also to assist the U.S. Agency for International Development and other development organizations in defining energy programs in Central America.

40863 **Methodology of project analysis under risk with reference to capital ventures in energy.** Abed, G.T. (International Monetary Fund, Washington, DC); Tourk, K.A. pp 831-894 of Alternative energy sources. Part B. Manassah, J.T. (ed.). New York, NY; Academic Press (1981).

From Symposium on alternative energy sources; Kuwait, Kuwait (1 Feb 1980).

Mathematical techniques for the analysis of capital ventures in general, with special reference to investments in the field of energy are surveyed and discussed. The analysis is developed in terms of decision making under risk. The paper presents a number of techniques for evaluating projects from the standpoint of economic viability and financial attractiveness. The methods of risk analysis presented include: direct adjustment for risk, break-even analysis, sensitivity analysis, random cash-flow analysis, decision trees and Monte Carlo simulation, and programming methods. Illustrative examples are presented and discussed. The techniques presented are intended for investors seeking to assess investment opportunities where simple, deterministic analysis may not be adequate. The basic statistical concepts needed to make the analysis of projects under risk are also developed.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 40857, 40868, 40876, 40896, 40897, 41414, 41420, 41460, 41565, 41566, 41605

40864 **(EMD—82-36) GAO's response to DOE's comments on EMD-81-108, Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 27 Jan 1982. 8p. General Accounting Office, Washington, DC 20548.

Recommendations are presented for major organizational changes in the safety and health oversight program at US DOE's

contractor operated nuclear facilities. These are designed to remedy specific program deficiencies. (PSB)

40865 **(HRP—0903042/0) Computed tomographic scanning and radiation therapy services: goals and standards, Georgia Health Service Area V. Plan implementation and review series.** (Comprehensive Health Planning in Southern Illinois, Inc., Carbondale (USA)). 31 Jan 1980. 84p. NTIS, PC A05/MF A01.

The computed tomographic scanning and radiation therapy services components are reproduced from the 1980 Central Georgia Health Plan. The computed tomographic service description discussed staffing criteria, quality of care, equipment, and procedures. Cost, incidence rates, and utilization are also discussed. A list of sources is provided. Three goals and one objective are stated with two long-range and one short-range recommended actions and rationale. Three standards for plan implementation are included. The description of radiation therapy services discussed different modes of treatment, incidence and utilization rates, and cost. A list of sources is provided. One goal and two objectives are stated with two long-range and one short-range recommended actions and rationale. One standard for plan implementation is included. The process through which the goals, objectives, and standards were adopted is described. This included the development of the project review function and the annual implementation plan implementation process. The appendix consists of committee rosters, meeting summaries, and attendance lists. Maps and tables are included.

40866 **(PB—81-242240) Practical demonstration of urban air quality simulation models. Part I. A report of the NATO/CCMS pilot study on air pollution assessment methodology and modeling.** (North Atlantic Treaty Organization, Brussels (Belgium). Committee on the Challenges of Modern Society). Aug 1980. 114p. (NATO/CCMS—106-PT-1). NTIS, PC A06/MF A01.

Portions of document are illegible.

Report shows cooperation of NATO member nations in developing standardized methods for emissions data storage and retrieval to support requirements in conduct of national air quality management programs. Shows cooperation in developing standardized techniques for projecting emissions and predicting future ambient air quality.

40867 **(PB—81-244915) Quantifying environmental impacts.** Shenk, C.A.; Riley, W. (Environmental Protection Agency, Seattle, WA (USA). Region X). May 1981. 46p. (EPA—910/9-81-086). NTIS, PC A03/MF A01.

How can environmental impacts be included in cost-effectiveness determinations. What methodologies and research are usable for quantifying those impacts. These questions are addressed. A methodology is developed to assess the cost-effectiveness of proposed electric power projects. Difficulties in physically measuring environmental impacts, and in subsequently placing dollar values on them are discussed. Impact mitigation costs and expert judgement techniques are also reviewed to determine their appropriateness for this process. Suggestions are made for properly structuring the decision-making process (related to Northwest power planning) to avoid the need for comparing completely unlike alternatives.

2904 Natural Resources

REFER ALSO TO CITATION(S) 40956

40868 **(LA-UR—82-443) Changing Western water institutions: energy's role.** Brown, F.L.; Roach, F. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 7p. NTIS, PC A02/MF A01. Order Number DE82008154.

This paper describes the institutional mechanisms through which physical availability of water, historical pattern of water use, and unresolved water issues combine to constrain and channel the energy industry's use of water. These institutional mechanisms include the developing markets for water rights, the legal and administrative structure governing water allocation, the formation of social attitudes about water, and the political process that often implements concensus. Within this context, the narrow physical interpretation commonly given to the question, Is there enough water, broadens greatly to include the institutional dimension that is the most important component of the question.

40869 **(NP—2903959) Water law, water conservation, and the development of energy resources in the coastal, offshore, and flood-plain areas of Alabama.** Cohen, H. (Alabama Univ., University (USA). School of Law). 1981. 97p. Univ. of Alabama, School of Law, University, AL 35486.

This report is about mineral development and water conservation in coastal areas of Alabama. Balancing concerns for energy demands and flood-plain controls are discussed. (PSB)

40870 **(PB—81-197071) State of Washington: a study of procurement of products containing recycled materials. Final report.** (Energy Enterprises Northwest, Olympia, WA (USA)). Mar 1981. 87p. NTIS, PC A05/MF A01.

The report examines the current State activities, regulations, statutes, and policies, as well as technical institutional and economic barriers relating to the public procurement of products containing recovered or recycled materials. The report also lists the top ten commodities procured by the State in dollars plus a listing of products that, in the opinion of the State, have a high potential for the use of recycled or recovered material. The report includes a list of recommendations or suggested actions that could be taken to potentially improve the manufacture, distribution, and procurement of products containing recovered or recycled materials.

40871 **(PB—81-198236) Procurement of products containing recycled/recovered materials in the state of Colorado. Final report.** (Colorado Dept. of Administration, Denver (USA). Div. of Purchasing). Mar 1981. 104p. NTIS, PC A06/MF A01.

The report examines the current State activities, regulations, statutes, and policies, as well as technical institutional and economic barriers relating to the public procurement of products containing recovered or recycled materials. The report also lists the top ten commodities procured by the State in dollars plus a listing of products that, in the opinion of the State, have a high potential for the use of recycled or recovered material. The report includes a list of recommendations or suggested actions that could be taken to potentially improve the manufacture, distribution, and procurement of products containing recovered or recycled materials.

40872 **(PB—82-102369) Water for energy: supplemental reports to the national water assessment (2nd). Report No. 1.** (Water Resources Council, Washington, DC (USA)). 1978. 134p. NTIS, PC A07/MF A01.

This report provides information on both historical and projected energy needs and the associated withdrawal and consumptive uses of water. It also discusses changing technology and environmental protection requirements.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 40900

40873 **(PB—81-140824) Energy link catalog. Volume 2. Energy resource catalog.** Stiko, P.T. (National Science Foundation, Washington, DC (USA). Div. of Engineering). Feb 1980. 136p. NTIS, PC A07/MF A01.

The Energy Link Project, through the development of a simplified resource/technology locator system, has improved the accessibility and usability of resources from the Federal Laboratory system in the energy field. This locator system was designed from the point of view of local government management. This orientation allows the user to identify his needs and then retrieve the resources applicable to alternative solutions from the Federal Laboratory system. Instructions are provided on how to use the catalog and obtain publications. Entries are categorized and include title, abstract, contact, and availability.

40874 **(PB—82-100785) Impediments to international energy R and D cooperation: a political, institutional and legal analysis.** Scheinman, L.; Auer, P.; Segal, A.; Koehler, W. Jr; Levy, S. (Cornell Univ., Ithaca, NY (USA)). May 1976. 153p. NTIS, PC A08/MF A01.

The experience of advanced industrialized countries in cooperative ventures of research and development (R and D) was analyzed. Both energy-related and other technologies were examined to find conditions under which the most fruitful cooperation has taken place and to identify those legal and institutional factors which inhibit cooperation. Defined are: (1) international R and D problems and prospects; (2) trends in the formulation of energy R and D policy; and (3) Canadian-American energy R and D relations. Differences in needs and priorities of individual nations were considered as prime factors in determining energy policies and related R and D programs. The absence of energy policies, the free market, environmental conflict, the energy crisis, supply and demand, reserves, resources and production, conservation, patterns of energy R and D, and international cooperation were all studied. The research energy R and D dealt with relations between Canada and the United States, capital and technical constraints, transgovernmental and transnational relations, and domestic factors.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 40272, 40273, 40281, 40297, 40323, 40328, 40653, 40722, 40723, 40750, 40766, 40782, 40864, 40911, 41565, 41566, 41929, 41938

40875 **(INIS-mf—6759) Brazilian Nuclear Energy Program.** de Cavalho, H.G. (Comissao Nacional de Energia Nucear de Brasil, Rio de Janeiro). (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1980. 71p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82780400.

A survey is initially of the international-and national situation regarding energetic resources. The Brazilian Nuclear Energy Policy and the Brazilian Nuclear Program are dealt with, as well as the Nuclear Cooperation agreement signed with the Federal Republic of Germany. The situation of Brazil regarding Uranium and the main activities of the Brazilian Nuclear Energy Commission are also discussed.

40876 **(NUREG—0764) Toward a safety goal: discussion of preliminary policy considerations. Regulatory report.** (Nuclear Regulatory Commission, Washington, DC (USA)). Mar 1981. 62p. NTIS PC A04/MF A01.

This report includes a Commission statement on preliminary policy considerations in development of an NRC safety goal and a supporting report providing a more detailed discussion. The discussion begins with an exposition of criteria by which the quality of different approaches to a safety goal may be judged. It next addresses alternative approaches to safety-goal formulation and presents some safety-goal proposals. Finally, there is a brief discussion of degree of safety.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 40825

40877 **(PB—82-106162) Procedures for preparing regional transportation management plans.** Goetz, M.J. (New England River Basins Commission, Boston, MA (USA)). Aug 1981. Contract DI-AA851-IOA-51. 177p. NTIS, PC A09/MF A01.

The procedures developed and presented in this report are designed to provide Regional Technical Working Group committees and other planners with a working framework for preparing Regional Transportation Management plans. These plans will ultimately be used to insure the safe and timely transportation of oil and gas produced offshore to onshore processing and distribution systems. The report is divided into two parts: Part I presents the various planning procedures, Part II is a case study application to the Georges Bank region of the North Atlantic Outer Continental Shelf.

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 40394, 41046, 41047

2910 Conservation

REFER ALSO TO CITATION(S) 40943, 40951, 40965, 40966, 40967, 40968, 41038

40878 **(EMD—82-20) Studies on effectiveness of energy tax incentives are inconclusive.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 11 Mar 1982. 43p. General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

The effectiveness of the tax incentives for conservation and alternative energy sources as contained in the Energy Tax Act of 1978 and the Crude Oil Windfall Profit Tax Act of 1980 is examined. Officials were interviewed, information was gained from private organizations, and discussions were conducted with government staff to determine the effectiveness of the tax measures. Information was sought on the role that tax incentives play in stimulating energy investments; reliable, current estimates on the energy savings or production effects of the energy tax incentives contained in the laws considered; and estimates of the cost of the Treasury of providing these incentives. It was concluded that the effectiveness of energy tax incentives is inconclusive. Principal studies on energy tax incentives conducted to date are described in Appendix I. Appendix II describes the specific tax incentives available under the Energy Tax Act and the Windfall Profits Tax Act. A summary of studies made on tax incentives for energy conservation and renewable energy sources is presented in Appendix III. The highlights on the Internal Revenue Service's energy tax credit data are covered in Appendix IV. (MCW)

40879 **(EMD—82-39) State Energy-Conservation Program needs reassessing.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA)). 21 Apr 1982. 47p. General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

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Energy conservation programs in three Federal regions and the State Energy Conservation Programs in six states in these regions were assessed. The effectiveness of the planned conservation measures, the validity of the programs' impact on energy use, and the adequacy of the financial, planning, and progress reporting and monitoring systems were examined. Recommendations for improvement in these areas are presented. (MCW)

40880 **Improving energy efficiency: the effectiveness of government action.** Hirst, E.; Fulkerson, W.; Carlsmith, R.; Wilbanks, T. (Oak Ridge National Lab., TN). *Energy Policy;* 10: No. 2, 131-142(Jun 1982).

Energy conservation involves the substitution of intelligence, prudence, maintenance, and better equipment for scarce, insecure, and costly energy. These substitutions improve efficiency of energy use and thereby enhance economic productivity. The benefits of conservation are clear, but the proper role for government is hotly debated. Although the normal workings of the market system are doing much to stimulate cost-effective conservation actions, several barriers to conservation still exist. Government programs are needed to help overcome these barriers. Present US Department of Energy conservation programs could reduce annual energy use by 2.7 quads in 1985 and by 13 quads in 2000. The present worth of the estimated cumulative oil-saving over 20 years is $50 billion, in addition to the savings realized by energy consumers themselves. 26 references, 6 figures, 1 table.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 40221, 40849, 40854, 40861, 40862, 40899

40881 (EUR—6770-EN) Input-output and energy demand models for Ireland: Data collection report. Part 1: EXPLOR. Henry, E.W.; Scott, S. (Economic and Social Research Inst., Dublin (Ireland)). 1981. 168p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

Data are presented in support of EXPLOR, an input-output economic model for Ireland. The data follow the listing of exogenous data-sets used by Batelle in document X11/515/77. Data are given for 1974, 1980, and 1985 and consist of household consumption, final demand-production, and commodity prices. (ACR)

40882 (EUR—7284-EN) Energy models for Denmark: EXPLOR, EDM, and EFOM. Final report. Fenhann, J.; Morthorst, P.E. (Risoe National Lab., Roskilde (Denmark)). 1981. 110p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The implementation of the energy models EXPLOR, EDM, and EFOM for Denmark is examined. The input-output model EXPLOR and the energy demand model EDM are implemented for Denmark for the years 1970, 1973, 1974, 1980 and 1985, where 1970 is chosen as the base year. For the energy flow optimization model (EFOM) a dynamc implementation was made to the year 2020. But in this medium-term model context, only a demand vector to the year 1985 was created. With this demand vector as input a dynamic demonstration run was made for the period 1974, 81, and 85.

40883 (EUR—7286-EN) Comparison of alternative energy-demand models. Final report. (Cambridge Econometrics Ltd. (UK)). 1981. 50p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

In the context of the EC energy modelling system the energy demand model (EDM) was developed in order to relate the gross output levels for energy consuming sectors, which are forecast by the EXPLOR input-output model, to the associated demands for secondary energy products. The EFOM supply model then optimizes the production of secondary products and, through models of the energy conversion processes employed in the economy, calculates the level of primary energy use. Three alternative versions of the EDM were designed by Cambridge Econometrics (for the UK), Battelle Geneva (for France), and Battelle Frankfurt (for all other EC countries). All three versions were designed to employ the same exogeneous variables to forecast the pattern of fuel demands: the price of specific fuels and the output (or, for households, consumption) of the sector concerned. These variables are either generated by the EXPLOR input-output model or can be derived by aggregation of EXPLOR tables. Any other variables required by the EDM (for example, temperature, the stock of private cars, time trends) are forecast exogenously. Similarly all three versions were designed to produce the same output describing the secondary energy demands presented to EFOM: a transition matrix giving final energy demand (in thermal units) by product and consuming sector. Since both input and output of the three versions of EDM are the same there are no problems involved in replacing one version by another. A description of these models is presented. A summary of the international comparison of alternative energy substitution models is also presented.

40884 (EUR—7290-EN) Reference Case 1990, Federal Republic of Germany: EC Energy Modelling, Level II. Final report. Mischke, H.; Bienewitz, K.H.; Puetzstueck, H. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). 1981. 48p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The Reference Case 1990 for the Federal Republic of Germany was established using the medium-term European Communities (EC) Energy Model. Methods developed and applied for updating the macroeconomic, input-output, and energy demand parts of the model were expertises, extrapolations, consistency algorithms, econometric estimations, and models. The results achieved are projections of macroeconomic, input-output, and energy demand variables until 1990. The gross domestic product has been forecast to grow by 2.76% between 1980 and 1990. The total output will grow by 2.66% per year within the same period. The corresponding growth rates of final and primary energy demand are 1.69% and 2.05%, respectively. The corresponding macroelasticities can be calculated as 0.61 and 0.74. The development of the structure of final energy demand between 1980 and 1990 is characterised by the decreasing importance of solid fuels and oil because of historical trends and the oil development of oil prices. (MCW)

40885 (EUR—7300-EN) UK case studies using the integrated EC energy-modelling system. Hughes, C.; Parry, N. (Cambridge Econometrics Ltd. (UK)). 1981. 62p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

Results obtained using the integrated European Communities (EC) energy modeling system for the United Kingdom (UK) are described. Three case studies showing different energy scenarios are discussed: a base case representing a reasonably plausible economic and industrial scenario; a case where the oil prices rise to a level 75% higher than base in 1990; and a case where gas prices are set at the thermal equivalent of oil prices by 1990. The simulations were carried out using the EC model system as it existed at the end of 1979. A detailed description of the major economic assumptions provided by the Cambridge Multisectoral Dynamic Model (MDM) which have been used in these case studies is presented in Appendix I. (MCW)

40886 (EUR—7333-EN) Preliminary energy demand studies for Ireland: base case and high case for 1980, 1985 and 1990. Henry, E.W. (Economic and Social Research Inst., Dublin (Ireland)). 1981. 96p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The framework of the Base Case and the High Case for 1990 for Ireland, related to the demand modules of the medium-term European Communities (EC) Energy Model, is described. The modules are: Multi-national Macre-economic Module (EURECA); National Input-Output Model (EXPLOR); and National Energy Demand Model (EDM). The final results of the EXPLOR and EDM are described; one set related to the Base Case and the other related to the High Case. The forecast or projection is termed Base Case because oil prices are assumed to increase with general price inflation, at the same rate. The other forecast is termed High Case because oil prices are assumed to increase at 5% per year more rapidly than general price inflation. The EXPLOR-EDM methodology is described. The lack of data on energy price elasticities for Ireland is noted. A comparison of the Base Case with the High Case is made. (MCW)

40887 (EUR—7390-EN) Energy models for Denmark: EXPLOR - EDM. Case studies, base and high case. Final report. Morthorst, P.E. (Risoe National Lab., Roskilde (Denmark)). 1981. 45p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

Case studies made with the energy models EXPLOR and EDM for Denmark are described. The input-output model (EXPLOR) and the energy demand model (EDM) are implemented for Denmark for the years 1970, 1973, 1974, 1980, 1985 and 1990, where 1970 is chosen as the base year. The models have been modified and improved. The EDM-model has been almost totally reestimated using the latest available data. Moreover, a new type of energy, district heating, has been introduced into the model. Although this has improved the results substantially, it is necessary to continue the development of the models. Especially, a new aggregation structure and a reestimation of the LES-function could prove advantageous. The modifications made in the models are de-

scribed. Especially, the EDM-model is treated in some detail. A comparison is given of the historical data used in the models and the results which the models compute, showing how they fit the historical data, are discussed. Results obtained in two case-studies are base case: energy prices constant in real terms; and high case: energy prices rising by 5% p.a. in real terms. A conclusion with comparison to other forecasts made for the energy consumption in Denmark is made.

40888 **(PB—81-232894) Federal, state and local responses to 1979 fuel shortages. Summary report.** Schueftan, O.; Ellis, R.H. (Peat, Marwick, Mitchell and Co., Washington, DC (USA); Department of Transportation, Washington, DC (USA). Office of the Secretary). Feb 1981. 52p. NTIS, PC A04/MF A01.

This report complements existing knowledge of transportation energy contingency planning with more in-depth information on (1) the types of emergency conservation measures actually taken during the 1979 fuel shortages by various levels of government and their effectiveness and (2) some promising actions for an energy contingency and their implications for responding to future fuel shortages.

40889 **Alternative energy systems and developing world needs.** Bunker, S.E. (National Rural Cooperative Association, Washington, DC). pp 895-922 of Alternative energy sources. Part B. Manassah, J.T. (ed.). New York, NY; Academic Press (1981).

From Symposium on alternative energy sources; Kuwait, Kuwait (1 Feb 1980).

In order to set into context the mechanics of Third World development and the role of alternative energy systems in that process, a brief overview of the shared characteristics of Third World economic systems is presented. The central role of agriculture, the generally high rate of population growth, and the predominant strategy of industrialization are all discussed in light of the steadily growing rate of energy consumption in LDCs. A survey of the alternative technologies most appropriate for application in Third World rural settings - where 70 to 80% of the population of a typical LDC live - is set forth in a generalized, non-technical fashion. They include hydroelectric power; wood-fired steam electric power; photovoltaics; wind power; anaerobic decomposition of wastes; geothermal power; fermentation of biomass for alcohol fuels; and other less known, but equally promising systems of energy production and conservation. The means by which energy programs can be established in LDCs is explored, with particular attention to the creation of regional energy institutes for country-specific adaptation of practicable, alternative energy systems. Further, the various functions of such institutes, as well as the likely shape of their technical and financial underpinnings, is briefly treated. The challenge of Third World energy supply is discussed.

40890 **Energy: stock-taking and perspective-with an annex on nontechnical aspects.** Haerter, M.; Lindner, R. Luxembourg; Commission of the European Communities (1981). 237p. (In German). (EUR—7075-DE). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Portions of document are illegible.

Perspectives of the energy crisis are discussed and a definition of energy is offered. The world energy situation, the energy situation in the European Communities, and the situation in the Federal Republic of Germany are described. The fundamental patterns of forecasting and assessing the energy situations are covered. Finally, the global energy problems are considered. (MCW)

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 40323, 40750, 40879, 40880

40891 **(PB—81-141129) Additional management improvements are needed to speed case processing at the Federal Energy Regulatory Commission. Report to the Congress.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 15 Jul 1980. 92p. NTIS, PC A05/MF A01.

The report discusses additional improvements needed in the Federal Energy Regulatory Commission's management of its caseload. This report contains a recommendation for consideration by the Congress, and points toward the need for strong congressional oversight to assure that improvements are implemented.

40892 **(PB—81-209967) Morocco energy study.** Jacobs, A.B.; Farber, E.B.; Gorden, M.; Izbickas, V.; Melby, E.D.K. (Agency for International Development, Washington, DC (USA)). 1978. 69p. NTIS, PC A04/MF A01.

In November 1978, a team of six U.S. energy specialists assisted the Government of Morocco in defining energy policies to further economic development and reduce Moroccan dependence on foreign oil. Three areas were reviewed: shale oil development, with emphasis on in situ retorting; hydroelectric production; and nonconventional energy sources. Oil shale represents Morocco's largest potential indigenous energy source. This report presents the team's findings and the conclusions drawn therefrom.

40893 **(PB—81-853913) Energy and natural resource monopolies. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 111p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning global and national aspects of monopolies and monopolistic practices. Governmental regulations for specific energy industry and natural resource monopolies are discussed. Attention is given to theoretical considerations of specific governmental regulations. (Contains 95 citations, fully indexed and including a table of contents.)

40894 **(PB—81-854663) Project Independence. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 142p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning studies and assessments of various energy scenarios and systems related to Project Independence. Citations give both general and individual consideration to energy technologies, sources, supplies, demands, and economics as well as to institutional factors affecting energy self-sufficiency for the United States. (Contains 129 citations, fully indexed and including a table of contents.)

40895 **(PB—81-854986) National and international raw materials policies. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 83p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning national and international governmental and economic policies concerning various aspects of raw materials from their location and exploitation to their conservation and political manipulation. (Contains 67 citations, fully indexed and including a table of contents.)

40896 **(PB—81-855934) Puerto Rico: energy and environment. January 1970-November 1980 (citations from the NTIS Data Base). Report for January 1970-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 173p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning energy policies, sources, supplies, and technology in Puerto Rico. It also contains citations relating to environmental impacts and protection from energy and industrial activities and from waste disposal from many sources. (Contains 150 citations, fully indexed and including a table of contents.)

40897 **(PB—81-855942) Puerto Rico: energy and environment. January 1970-November 1980 (citations from the Energy Data Base). Report for January 1970-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 135p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning energy policies, sources, supplies, and technology in Puerto Rico. It

also contains citations relating to environmental impacts and protection from energy and industrial activities and from waste disposal from many sources. (Contains 110 citations, fully indexed and including a table of contents.)

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 40174, 40189, 40190, 40191, 40203, 40218, 40219, 40219, 40221, 40222, 40247, 40256, 40653, 40892, 40906, 40906, 40906

40898 (NP—2750064) Law No. 293 of 10 Jun. 1981 about utilization of the Danish underground. 10 Jun 1981. 6p. (In Danish). Risoe Library, DK-4000 Roskilde, Denmark.

The law provides the purposeful use and utilization of the Danish underground and its natural resources. The law applies to prospecting, exploration and recovery of resources which had not been economically utilized by private enterprise prior to 23 Febr. 1932. The underground can be utilized as storage place or for other purposes besides recovery. Recovery and research apply as well to the continental Danish shelf. Detailed rules to follow in underground exploration and utilization are precised.

40899 (PB—81-865511) Developing countries: fossil fuels. January, 1976-May, 1981 (citations from the Energy Data Base). Report for January 1976-May 1981. (National Technical Information Service, Springfield, VA (USA)). May 1981. 171p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning fossil fuels in OPEC and Non-OPEC developing countries as well as the effects of the policies and actions of developed countries upon fossil fuels availability and utilization. Political, social, economic, and technical aspects of fossil fuels in and for the third world are considered. (Contains 155 citations fully indexed and including a title list.)

40900 (PB—81-866089) The fossil energy program: reports. January, 1976-May, 1981 (citations from the Energy Data Base). Report for January 1976-May 1981. (National Technical Information Service, Springfield, VA (USA)). May 1981. 89p. NTIS PC N01/MF N01.

Citations in this retrospective bibliography cover research and development progress of the government sponsored Fossil Energy Program. Various aspects of the Program are considered, including the technical, environmental, economic, and commercial ones. (Contains 60 citations fully indexed and including a title list.)

2960 Electric Power

REFER ALSO TO CITATION(S) 41432

40901 (DOE/RG/08077—T1) Wisconsin residential time-of-day rate demonstration project. (Wisconsin Public Service Commission, Madison (USA)). Apr 1981. Contract FC01-75RG08077. 66p. NTIS, PC A04/MF A01. Order Number DE82011509.

The Wisconsin Time-of-Day (TOD) Rate Demonstration Project was a four-year experiment begun in 1975 to determine how residential electric power consumers with different life styles, appliance stock and levels of electricity usage respond to new rate forms, particularly time-of-use rates with varying prices and peak lengths. This report reviews the design of the project, the selection of the 700 plus consumers, the design of the rate schedules, the development of questions to provide meaningful data on the effects of TOD rates, the types of data collected, and the results obtained. Among the general conclusions were that: customer knowledge and understanding TOD rates was an important factor in changing time-of-use patterns; most customers felt the TOD rates were fair and reasonable; overall power consumption did not decrease, but residential demand load peaks were reduced by 20 to 30%, and usage patterns were time-shifted. Abstracts of numerous papers on specific aspects of this project, e.g., weather effects on response to TOD pricing, effects of various pricing patterns, customer attitudes, are included. (LCL)

40902 (EPRI-EA—2204) Models for investment and disinvestment decision making under uncertainty. Final report. Robison, K.J.; Abkin, M.H. (eds.). (Michigan State Univ., East Lansing (USA). Dept. of Agricultural Economics). Jan 1982. 200p. NTIS, PC A09/MF A01. Order Number DE82902068.

The report reviews, extends and adapts for empirical work the theoretical framework for decisions regarding the investment, disinvestment and use of durable assets under conditions of uncertainty. The relevance to the utility industry is that their ability to supply a time-varying demand for their product depends on the accumulation of investments, disinvestments and use of durable assets. A general framework is presented for prescribing durable investment and related decisions. In order to do so, relationships are identified that account for capacity and inventory costs as well as identifying the interdependencies between the two in a dynamic (time) analysis. To aid in the decisionmaking process under uncertainty, while accounting for unique risk preferences, a new risk-efficiency criterion is reviewed. In addition, a measurement technique for identifying risk preferences is introduced. Utilizing the theoretical developments and the new risk-efficiency criterion for ordering action choices, a general simulation model was then developed. The model, of intermediate complexity, is intended to be used in the initial stages of screening investment options. In an empirical test, the newly developed model obtained nearly the same results as the well-established Minimum Revenue Requirements method. The new theory and simulation model, however, have broader capabilities for application at the capacity or corporate planning level.

40903 (LA—9127) POPCYCLE: a computer code for calculating nuclear and fossil plant levelized life-cycle power costs. Hardie, R.W. (Los Alamos National Lab., NM (USA)). Feb 1982. Contract W-7405-ENG-36. 39p. NTIS, PC A03/MF A01. Order Number DE82009184.

POPCYCLE, a computer code designed to calculate levelized life-cycle power costs for nuclear and fossil electrical generating plants is described. Included are (1) derivations of the equations and a discussion of the methodology used by POPCYCLE, (2) a description of the input required by the code, (3) a listing of the input for a sample case, and (4) the output for a sample case.

40904 (PB—81-193138) Electric generation capacity planning for the Delmarva Power and Light Company: analysis of the proposed Vienna Unit No. 9. Final report. Miller, R.E. (Exeter Associates, Bethesda, MD (USA)). Apr 1981. 86p. NTIS, PC A05/MF A01.

This report is an essay on the electric utility generation planning process, with particular reference to the application of Delmarva Power and Light Company (DPandL) for a license to construct a new 500-megawatt coal-fired generating unit at Vienna, Maryland. One major part of this report addresses the question of when additional generating capacity will be needed by DPandL to serve projected growth in peak loads. The other major part concerns the question of whether it is desirable for DPandL to invest in new coal-fired baseload generating capacity before the time this capacity is required to serve growth in peak loads, so as to achieve savings in fuel costs. This second part is thus an analysis of the appropriate size and timing for Vienna 9. This analysis incorporates the results from a financial model for the fixed costs of Vienna 9 and a production costing model for the operating costs of the entire DPandL system.

40905 (PB—81-194409) An econometric forecast of electric energy and peak demand on the Delmarva Peninsula. Final report. Kahel, M.I.; Miller, R.E. (Wilson (J.W.) and Associates, Inc., Washington, DC (USA)). Mar 1980. 358p. NTIS, PC A16/MF A01.

This report presents forecasts of electric power demands through 1995 for the Delmarva Peninsula. Forecasts are based upon a series of econometric equations of the demand for electricity. Residential energy usage (per customer) is explained mainly by real income, electricity prices and weather, while commercial and industrial usage (per employee) is explained mainly by the wage rate and electricity prices. All energy equations are made dynamic through the use of a lagged dependent variable. A number of fore-

cast scenarios were constructed based upon varying assumptions concerning the local economy, electricity prices and regulatory practices.

40906 **(PB—81-240442) Fuels and electric energy consumed. Subject series 1977.** (Bureau of the Census, Washington, DC (USA)). Feb 1981. 25p. NTIS PC MF A01.

This report from the 1977 Census of Mineral Industries is one of a series of 7 subject reports. Reports in this series cover a general summary, type of operation, size of establishment, type of organization, assets and capital expenditures, fuels and electric energy consumed, and water use.

40907 **(PB—81-856635) Peak-load pricing. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 278p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning electric utilities' peak-load pricing policies, methods, equipment, and socioeconomic impacts on residential and industrial electric power consumption. Analyses of general concepts and specific applications and experiences are presented along with considerations of advantages and disadvantages of time-of-use rates and studies of electric utility rate structure designs. (Contains 275 citations, fully indexed and including a table of contents.)

40908 **(SSEC/SP—31224) Residential electricity rates for the United States for Solcost Data Bank cities.** Smith, L.E. (Southern Solar Energy Center Planning Project, Atlanta, GA (USA)). May 1981. Contract AC02-79CS30166. 12p. NTIS, PC A02/MF A01. Order Number DE82009468.

Electricity rates are given for selected cities in each state, first of the Southern Solar Energy Center region and then of the rest of the US, for an average residence that uses 1000 kWh a month. (LEW)

40909 **Data transfers among electric utilities.** Ackerman, G.B. (Systems Control, Inc., Palo Alto, CA). *Public Utilities Fortnightly;* **109**: No. 9, 35-42(29 Apr 1982).

Data borrowing from other utilities is an activity that remains attractive for electric-utility systems unable to embark upon their own load-research programs for reasons of cost or staffing. However, there seem to be few established precedents to guide utilities in the successful pursuit of this activity. This article outlines the key considerations and potential problems for utilities that choose to borrow load data rather than generate data through their own controlled experiments. A hypothetical example illustrates how a utility may evaluate its data-borrowing options for load management purposes. 1 figure, 3 tables.

40910 **European Atomic Energy Community report. Part I: comparative risks from electricity generating systems. Final report. Part II: risk assessment of energy systems.** Luxembourg; Commission of the European Communities (1981). 125p. (EUR—7532-EN). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037 $9.40.

This report contains two sections. The first reviews literature on risk analysis and assessment for power generation using fossil-fuel, nuclear, and hydroelectric power plants and includes risks related to activities such as fuel extraction and transport plant construction accidents, and waste disposal. Abstracts of 8 papers of special value are presented. The second section discusses risk analyses for electric generating systems used in the European Economic Community, and compares the assessment methods used and results obtained. (LCL)

40911 **Industrial adjustment and policy. III. European power plant industry: structural responses to international market pressures.** Surrey, J.; Walker, W. Sussex, England; Sussex European Research Centre (1981). 97p. (NP—203490). Sussex European Research Centre, Univ. of Sussex, England.

Portions of document are illegible.

Against the background of a widespread, but not universal, slump in power station ordering since the mid-1970s and intensified export competition, this paper considers the prospects for West European power plant suppliers over the next 10 to 15 years. It examines the evolving relationships between governments, utilities and plant suppliers, and the possibilities for further structural adjustment to enable European firms to meet competition from Japan and the US, to adapt to changes in Third World export markets, and to keep abreast with technical change. The primary industrial focus is on the main contractors for conventional and nuclear generating plants (particularly the electrotechnical firms) in France, Germany, Switzerland, Britain and Italy, which constitute the core of the European industry.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 40972, 40996, 40999

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 40373, 40396, 40416, 40418, 40424, 40448, 40451, 40648, 40651, 40653, 40661, 40674, 40878, 40889, 40892, 40971

40912 **(ID—82-17) Departments of Energy and Commerce programs to promote solar products in foreign markets.** (General Accounting Office, Washington, DC (USA). International Div.). 12 Feb 1982. 37p. General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

During fiscal year 1981, the International Market Development Program conducted a series of overseas trade shows and seminars which produced immediate sales of about $3 million and from which participants projected 12-month future sales of about $60 million. The fiscal year 1982 Department of Energy budget eliminated the Program. The strong indication of the industry's export potential, however, has led the Department of Commerce to schedule an exploratory series of promotional events devoted to renewable energy products.

40913 **(PB—81-145658) Cameroon renewable energy: project possibilities.** Steedman, C. (Steedman (Charles), Ann Arbor, MI (USA)). 1 Aug 1979. 60p. NTIS, PC A04/MF A01.

This study identifies the actions necessary to assess Cameroon's energy needs, and makes recommendations to a design team for a USAID project to promote renewable energy sources. The author describes current renewable energy source activities in Cameroon, discusses the individual elements of a possible energy development program, and suggests prototype renewable energy technologies for field application.

40914 **(PB—81-865529) Developing countries: non-solar renewable energy. January, 1976-May, 1981 (citations from the Energy Data Base). Report for January 1976-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 55p. NTIS PC N01/MF N01.

This retrospective bibliography contains selected citations concerning non-solar renewable energy sources, techniques, and technology in developing countries. Biomass/biogas and windpower are the chief energy sources considered. Some attention is given to energy conservation in conjunction with renewable energy. The provision of appropriate technologies by developed countries is also covered. (Contains 44 citations fully indexed and including a title list.)

30 DIRECT ENERGY CONVERSION

REFER ALSO TO CITATION(S) 40710

3001 Mhd Generators

REFER ALSO TO CITATION(S) 40922

40915 **(NASA-CR—165452-VOL-1) Magnetohydrodynamics (MHD) engineering test facility (ETF) 200 MWe power plant. Conceptual design engineering report (CDER). Volume 1: executive summary. Final report.** (Gilbert/Commonwealth, Reading, PA (USA)). Sep 1981. 48p. NTIS, PC A03/MF A01.

Main elements of the design are identified and explained, and the rationale behind them was reviewed. Major systems and plant facilities are listed and discussed. Construction cost and schedule estimates are presented, and the engineering issues that should be re-examined are identified. The latest (1980-1981) information from the MHD technology program is integrated with the elements of a conventional steam power electric generating plant.

40916 **(NASA-TM—81965) Solar-driven liquid metal magnetohydrodynamic generator.** Lee, J.H.; Hohl, F. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). May 1981. 16p. NTIS PC A02/MF A01.

A solar oven heated by concentrated solar radiation as the heat source of a liquid metal magnetohydrodynamic (LMMHD) power generation system is proposed. The design allows the production of electric power in space, as well as on Earth, at high rates of efficiency. Two types of the solar oven suitable for the system are discussed.

40917 **(PB—81-808909) Magnetohydrodynamic generators in power generation. 1964-August 1981 (citations from the NTIS data base). Report for 1964-August 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 351p. NTIS PC N01/MF N01.

The citations include research on performance, costs, efficiency, and design of MHD generators and their use in fusion and fission reactors, and fossil fueled plants. (This updated bibliography contains 342 citations, 70 of which are new entries to the previous edition.)

40918 **(PNL—4001-1) Development of materials for open cycle MHD. Quarterly report for the period ending March 1981.** Bates, J.L.; Marchant, D.D. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1982. Contract AC06-76RL01830. 59p. NTIS, PC A04/MF A01. Order Number DE82008777.

The work centers around the development and fabrication of the HfO_2-RE/sub x/O/sub y/ electrodes and HfO_2-RE/sub x/O/sub y/-In_2O_3 current leadouts for testing in MHD facilities. The electrical conductivity of some potential HfO_2-RE/sub x/O/sub y/ refractory electrodes has been measured and preliminary results analyzed in relationship to structure and composition. Six potential air preheater materials, tested in the Montana State University heat exchanger, were characterized and evaluated. The potential mechanisms for corrosion/erosion are discussed. Electrochemical corrosion of platinum in molten coal slag was also measured. Possible corrosion mechanisms are discussed.

3003 Thermoelectric Generators

REFER ALSO TO CITATION(S) 40337, 40338

40919 **(DOE/ET/33062—T5) Thermoelectric generator testing and RTG degradation-mechanisms evaluation. Progress report No. 32.** Lockwood, A. (Jet Propulsion Lab., Pasadena, CA (USA)). Oct 1979. Contract AI03-79ET33062. 41p. NTIS, PC A03/MF A01. Order Number DE82007171.

Thermal conductivity tests of the older p-type were terminated after 22,000 hours. The n-type selenide legs after 8000 hours continue to show agreement with the 3M Company published data. In the ingradient testing after 10,200 hours the n-legs show comparable performance to the reported 3M data. A new station for ingradient performance testing of the new design p-type legs with the Astroquartz/slurry wrap was nearly completed. Weight loss testing of the new design p-type TPM217 (no partition) with the Astroquartz/slurry wrap has been discontinued. A check of the last sample after 2649 hours at T/sub H/900°C and T/sub C/150°C shows a low weight loss rate, but the hot cap popped off during test. Three 18 couple modules s/n-1,2, and 3 previously tested at RCA were received for JPL test and evaluation. S/n-1 was put on test. Testing of the ring converter was terminated after 40,939 hours. The remaining MHW generator, Q1-A, on test has accumulated 16,924 hours and performance remains stable. The performance of the Voyager 1 and 2 RTGs is reported after 17,897 hours and 18,448 hours of operation, respectively.

3005 Fuel Cells

40920 **(EUR—6960) Economic impact of hydrogen fuel cells. Final report.** Breelle, Y.; Choffe, B.; Grehier, A. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison). 1980. 159p. (In French). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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Three types of fuel cells are being developed: (1) low temperature hydrogen cells, based on alkaline hydrolysis; (2) medium temperature hydrogen cells, based on acid hydrolysis; (3) high temperature hydrogen cells, based on carbonate melts. The first two are nearly ready for practical application, whereas the third is still at the laboratory stage. There is likely to be a market for two kinds of applications, mobile and fixed. The most appropriate type of cell seems to be the hydrogen fuel cell, based on alkaline hydrolysis. A general survey has been made to estimate the relative importance of the markets: special oceanographic applications, offshore oil and mineral applications, space research, low power electricity generators for use in leisure activities (boating, sailing, caravaning). Before general, large-scale applications of fuel cells can be envisaged, an infrastructure for the distribution of hydrogen would have to be established. If confirmation is forthcoming in the near future of the benefits claimed in this economic study for the use of these fuel cells, capital expenditure of a corresponding size would be justified. 48 references.

40921 **(EUR—7070-FR) Synthesis and characterization of new lithium solid electrolytes.** Levasseur, A. (Bordeaux-1 Univ., 33 (France)). 1981. 24p. (In French). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

New vitreous electrolytes with fast ion Li^+ carriers have been obtained in the systems B_2O_3 - Li_2O - Li/sub n/MO_4 (n = 2; M = S, W, Mo; n = 3, M = P; n = 4, M = Si). Some of these glassy materials have a conductivity higher than $10^{-3}\Omega^{-1}cm^{-1}$ at 200°C. The conductivity is all the more higher as the oxide and lithium salt rates increase. Studies by techniques sensitive to local ordering have shown that the materials seem to be constituted by a B_2O_3-xLi_2O framework, in which the coordination number of boron shifts from III to IV with rising x. In the systems involving lithium sulfate, molybdate or tungstate the lithium salt is diluted in the vitreous matrix without detectable interaction with the surrounding matrix. On the contrary, in the systems using lithium phosphate or silicate, the lithium salt combines with the covalent matrix B_2O_3 - Li_2O. The electrolytes have been used in electrochemical chains. It was shown in particular that the transference resistance of lithium at the interface lithium-glass is negligible.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 40726

40922 **(INIS-mf—6811) Annual report 1980.** (Stichting Energieonderzoek Centrum Nederland, The Hague). Jul 1981. 76p. (In Dutch). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82780403.

The Energy Study Centre of ECN gives briefly the progress of the energy modeling studies, integral energy scenarios, the

energy-supply studies and energy demand studies. The substitution of crude oil into other energy sources for the Netherlands has been described. The introduction of solar heating systems in the Netherlands has been economically analysed. The sociological impact in households for energy conservation has been investigated. The Project Office of Energy Research reviewed the management of the national and international cooperation in the research programs of wind power, solar energy, coal technology, flywheels and MHD conversion. The research projects of ECN in the fields of nuclear physics and technology, nuclear fusion and superconductivity, combustion energy - fluidized bed combustion of coal and MHD conversion -, pollution control of aerosols, reactor operation and maintenance of the HFR and LFR reactors, reactor safety studies in the fuel cycle, the radioactive waste storage and the wind energy, have been reviewed. There follows a list of seminars held and publications. Details have been given of personnel, finance and the accounts.

3201 Buildings

REFER ALSO TO CITATION(S) 40255, 40524, 40530, 40550, 40552, 40559, 40561, 40563, 40566, 40567, 40572, 40575, 40579, 40585, 40597, 40621, 40624, 40625, 40826, 41046, 41047, 41667

40923 **(AD-A—103073/3) Energy factors and temperature distribution in insulated built-up roofs. Technical note July 1977-January 1980.** Keeton, J.R.; Alumbaugh, R.L. (Civil Engineering Lab. (Navy), Port Hueneme, CA (USA)). Feb 1981. 84p. (CEL-TN—1600). NTIS, PC A05/MF A01.

Surface temperatures of 4-ply built-up roofs insulated with (1) 1 inch of perlite (R = 2.8) and 2-1/2 inches of urethane (R = 19.2) and (2) 1 inch of urethane (R = 7.1) and 1-7/8 inches of glass fiber (R = 7.7) are presented. Energy factors are shown in terms of temperature-time areas defined as solar heat response, cooling (heating) required, radiative cooling, and insulation efficiency. Results indicate that for a black surface, solar heat response is significantly higher in the roof portion with the higher R-value. Solar heat response is directly affected by color of surfacing; lowest to highest values were found with white, white gravel, gray gravel, aluminum-gray, and black. Recommendations are given for reducing surface temperatures of insulated built-up roofs.

40924 **(AD-A—103107/9) Low-energy structures concepts. Final report October 1977-September 1980.** Odello, R.J. (Civil Engineering Lab. (Navy), Port Hueneme, CA (USA)). Dec 1980. 30p. (CEL-TN—1598). NTIS, PC A03/MF A01.

This report has discussed various concepts for energy conservation in Navy shore facilities which can be achieved through architectural and structural design decisions. These concepts include earth-sheltered structures, thermal mass concepts, passive solar designs, and exploitation of existing technology. Advantages and disadvantages of the systems were discussed in qualitative terms. Where possible, specific data and equations were presented to show how the benefits could be evaluated for specific designs. Sufficient information is available here and in the references to permit a designer to evaluate any of the concepts for applicability to a specific design case.

40925 **(AD-A—104133/4) Effect of temperature set-back on heat pump performance. Draft report (final), 1 Mar 80-1 Apr 81.** Kurtz, S.E. (Johns-Manville Sales Corp., Denver, CO (USA). Research and Development Center). 1 Apr 1981. Contract DAAK70-78-D-0002. 173p. NTIS, PC A08/MF A01.

This report documents an analysis which shows that energy savings and corresponding cost savings could be realized by employing set-back strategies dependent on location, heat pump capacity and amount of set-back.

40926 **(BMFT-FB-T—80-072) Heat energy consumption and intermittent heating. Final report.** Koenig, N.; Kupke, C. (Fraunhofer-Inst. fuer Bauphysik, Stuttgart (West Germany)). Aug 1980. 55p. NTIS, PC A04/MF A01.

A quantitative assessment of the possible reduction in space heating energy consumption when using an intermittent heating mode as compared to a continuous heating mode is offered. In situ measurement methods used in rooms with different heat storage capacity and different heating systems or heating appliances are described. A calculation program to demonstrate the effect of system parameter variation on energy consumption is presented. A comparison of experiment with calculations indicates that in an ordinary residence an energy savings of 10 to 35% can be achieved by employing an intermittent heating mode, depending on the type of wall construction and the number of hours various rooms are in use. Moreover, for the heating of offices and factories, the use of electronic control systems can lead to savings of 50% in heat energy consumption. (ESA)

40927 **(BMFT-FB-T—80-121) Development of an optimizing method for the design of a buried pipeline system to be used as a heat source for heat pumps. Final report.** Voncube, H.L. (Ingenieurbuero Sattlegger); Ludwig, E. (Ingenieurbuero Sattlegger). (Cube Ingenieurunion G.m.b.H., Worms (West Germany)). Aug 1980. 317p. NTIS, PC A14/MF A01.

A calculation method suitable for EDP calculation with difference steps for space and time, which allows the representation of isothermic lines and the calculation of heat flow to and from the ground as well as freezing processes by the solution of a two dimensional linear operator (Crank-Nicolson method), was developed. The physical characteristics of the ground were assessed, including heat transmission into the air and to deeper surface layers. Theoretical and mathematical methods of calculating ground temperature fields were then reviewed. Design criteria are determined, concerning the pipe laying method, the dimensioning of the pipe, and the predicted density of heat flow. (ESA)

40928 **(BMFT-FB-T—80-143) Fuel savings with conventional hot water space heating systems by incorporating a natural gas powered heat pump. Preliminary project: development of heat pump technology. Final report.** Vanheyden, L.; Evertz, E. (Ruhrgas A.G., Essen (Germany, F.R.)). Dec 1980. 227p. NTIS PC A11/MF A01.

Compression type air/water heat pumps were developed for domestic heating systems rated at 20 to 150 kW. The heat pump is driven either by a reciprocating piston or rotary piston engine modified to operate on natural gas. Particular features of natural gas engines as prime movers, such as waste heat recovery and variable speed, are stressed. Two systems suitable for heat pump operation were selected from among five different mass produced car engines and were modified to incorporate reciprocating piston compressor pairs. The refrigerants used are R 12 and R 22. Test rig data transferred to field conditions show that the fuel consumption of conventional boilers can be reduced by 50% and more by the installation of engine driven heat pumps. Pilot heat pumps based on a 1,600 cc reciprocating piston engine were built for heating four two-family houses. Pilot pump operation confirms test rig findings. The service life of rotary piston and reciprocating piston engines was investigated. The tests reveal characteristic curves for reciprocating piston engines and include exhaust composition measurements.

40929 **(BMFT-FB-T—80-152) Fuel conservation in conventional hot water heating systems by incorporating a gas oriented heat pump. Development of a hybrid piston pump/piston engine. Final report.** Pohle, J.; Wiedemann, B. (Volkswagenwerk A.G., Wolfsburg (Germany, F.R.)). Dec 1980. 176p. NTIS PC A09/MF A01.

The possibility of reducing energy consumption 50% by utilizing an internal combustion engine, driving a heat pump connected to a conventional central heating system, is shown. Taking standard engines from motor vehicle production lines, then modifying them to run on natural gas, complete prototype heat pump systems with infrequent maintenance requirements and prolonged life were developed. The main feature of the modified engine design is that part of the block is used as a compressor for the pump. The manufacture of the engine is only practical if it is possible to reduce production costs to below that of existing compact units. Extensive

field tests are recommended in order to prove the economy of the system.

40930 (CONF-810832—, pp 3.1-3.3) **VIS: variable insulation systems using fabric materials.** Gill, S.P. (ABRI Inc., Boston, MA). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30518.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Research on a thermal blind and light control system constructed of lightweight spun-bonded polyester fabric is described. The system is particularly designed to modulate daylight through large glazed areas in curtain wall office buildings. (MHR)

40931 (CONF-810832—, pp 3.21-3.23) **Honeycomb thermal curtain development.** Klodt, G.J. (Kool View Co. Inc., Madison, WI). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30525.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The material, hardware, and test equipment for a honeycomb structure insulating drapery for use on traverse rods are described. (MHR)

40932 (CONF-810832—, pp 3.67-3.69) **Insulating curtain wall.** Low, D. (Thermal Tech. Corporation of Aspen, Inc., Broomfield, CO). Feb 1982. NTIS, PC A17/MF A01. Contract FC02-80CS30585.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The product is a roll-down shade device consisting of four layers of highly reflective, low emissivity fabrics and is used to both insulate and shade windows, Trombe wall, and greenhouse apertures. The following accomplishments are summarized: relocation of production facility, product redesign, field and laboratory testing, component durability testing, and marketing. (MHR)

40933 (CONF-810832—, pp 4.8-4.11) **Design + Energy.** Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

40934 (CONF-810832—, pp 6.16-6.18) **Daylighting research activities in the energy efficient buildings program.** Selkowitz, S. (Lawrence Berkeley Lab., CA). Feb 1982. NTIS, PC A17/MF A01.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

Progress is reported in the following areas: daylight resource assessment, design analysis, annual energy calculation, load management and peak load impacts, daylighting controls, commercial building optimization, field measurement and evaluation, innovative daylighting strategies, and resource center activities. (MHR)

40935 (CONF-810832—, pp 6.39-6.42) **Earth contact systems.** Meixel, G.D. Jr.; Bligh, T.P.; Knoth, B.H.; Smith, E.A. (Underground Space Center, Minneapolis, MN). Feb 1982. NTIS, PC A17/MF A01. Contract AC03-80SF11508.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The development of a multi-dimensional heat conduction and moisture migration model for earth contact systems for buildings is discussed. The existing energy transport models are listed. Experimental computer model validation and soil temperature measurements are described. (MHR)

40936 **(EUR—7046-EN) Minimization of the power consumption of a heat pump by a microprocessor-based control system.** (Commission of the European Communities, Brussels (Belgium). Directorate General for Research, Science and Education). 1981. 17p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Various models describing the behavior of the heat pump were developed. The applicability of the models to the optimal operation of the heat pump was also investigated. Fixed theoretical models derived from geometrical considerations and physical properties were found to be sensitive to coefficient variations. Furthermore accurate models were too big for application to microprocessor. As a result a real time simple model was developed. This model is small enough to be adequate to microprocessor application. The accuracy of the model is assured by real time measurement and coefficient calculation. Further work is planned in testing the model in real time on the microprocessor connected to the heat pump. Models for representing the heat pump under steady state and transient conditions were developed. Although the theoretical models are too large for microprocessor applications, they provide a very useful tool in the design and development of heat pump systems.

40937 **(EUR—7048-EN) Analysis of the factors which determine the COP of a heat pump and a feasibility study on ways and means of increasing same. Final report.** Fordsmand, M.; Eggers-Lura, A. (European Heatpump Consultors Ltd., Charlottenlund (Denmark)). 1981. 136p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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Factors connected with heat pump system are analyzed. Heat extraction sources for a water/water heat pump considered are water, air, ground, solar collectors, and recovered heat. Heat delivery installations considered are water radiators, air, coil units, floor heating, and suspended ceiling heating. Domestic hot water supply combined with space heating or supplied by a separate air/water heat pump is analyzed. Data on conditions of the ground and data relating to ground heat pumps in combination with solar collectors are presented. Two simplified models for the calculation of the heat output from horizontal and vertical ground pipes are described. In Skive, a solar/heat pump house was constructed to demonstrate a low energy-consuming dwelling. Design and performance are described and results are presented. (MCW)

40938 **(EUR—7098-EN) Development of domestic heat pumps.** McMullan, J.T.; Morgan, R. (New Univ. of Ulster, Coleraine (UK)). 1981. 94p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

The program was aimed at the development of domestic heat pumps, and at improving and developing a control strategy. This involved both experimental developments in the laboratory and field testing of pre-production prototypes, together with extensive computer analysis of the experimental data and computer modeling of the behavior of system components. The experimental measurements were conducted in a highly flexible controlled environment laboratory which allows extensive variation of both temperature and humidity to match outdoor conditions. Experimental and theoretical modeling showed that the probable contribution of the latent heat of air-borne water to the evaporator heat pick-up, in between 10 and 13%. When investigating the effects of refrigerant turbulation, it quickly became apparent that the degree of turbulation was already high, but that at no point in the evaporator did tube-wall dry-out occur. When this factor was coupled with the observation that saturation pressure and temperature did not correspond to the published refrigerant data, it was realized tht the lubricant was playing an important role. This was investigated and a number of conclusions were drawn. The economic analysis of the field tests showed that under those conditions, the heat pump shows a likely payback period of 2 1/2 years against a new oil-fired system.

40939 **(EUR—7133-DE) Heat conservation in the heating and hot water supply in multi-family dwellings by the introducting of a gas motor-driven monovalent heat pump using outside air down to -12°C external temperature as the heat source.** Heiburg, O. (Dortmunder Stadtwerke A.G., Dortmund (Germany, F.R.)). 1981. 32p. (In German). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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Energy conservation by use of a gas engine driven heat pump using outside air as heat source is discussed. A monovalent

heat pump consisting of a reciprocating gas engine driving a reciprocating compressor supplies a dwelling house with 64 apartments with heat and hot water. Heat capacity is 465 kW at a temperature of -12°C. First the gas engine was fueled with coke-oven gas containing 57.4% hydrogen and later on the type of gas was changed to natural gas. The heat pump system using R 22 as refrigerant had a real running time of about 2500 to 3000 hours/year. The installation operated up to -12°C as demonstrated in the 1978/79 frosting period. Compared with conventional heating systems, the systems saved about 50%, on fuels consumption. Under these conditions the pay back period is less than 10 years.

40940 **(EUR—7281-EN) Frosting and defrosting behaviour of outdoor coils of air-source heat pumps.** Bouma, J.W.J. (Nijverheidsorganisatie TNO, Apeldoorn (Netherlands)). 1981. 106p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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The purpose of the project is to get an insight in the factors influencing the behavior of outdoor direct-expansion coils of air-source heat pumps on frosting and defrosting. Improving the design of the coils will yield energy savings, due to a smaller fan energy consumption, less frequent defrosting, and less heat required for defrosting. Data were collected about the experience with air-source heat pumps in practice; process conditions were determined in a representative air-source heat pump under different climatological conditions. Heat and mass transfer were studied during frost formation and an experiment was carried out with several types of outdoor coils. Conclusions are summarized. (MCW)

40941 **(EUR—7283-EN) Minimisation of the power consumption of a thermodynamic heat pump by a microprocessor-based control system. Final report.** Wilson, D.R.; Green, R.K.; Neale, D.F.; Searle, M.; Bird, K.E.; Tassou, S.A.; Wang, Y.T.; Nelson, G.; Court, B.; Harding, S. (P.C.L., London (UK)). 1981. 90p. Commission of the European Communities, Directorate-General for Information Market and Innvoation, Jean Monnet Building, Luxembourg.

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Two major drawbacks with conventional air source heat pumps are limited low temperature heating capacity and much less than optimum coefficient of performance at higher ambient temperatures. Both of these problems, which are related to a widely changing refrigerant flowrate with changing compressor suction pressure, can be overcome by introducing capacity control. To study the performance of a variable capacity heat pump and to implement control strategies that will minimize the energy consumption of the system over a range of operating conditions, an electrically driven air to water heat pump has been designed and tested. The performance characteristics of this advanced system when operating both under full load and part load conditions were established and its ability to conserve energy when compared to a conventional system was demonstrated. Results show that an improvement in energy savings of around 9% can be achieved.

40942 **(EUR—7377-EN) Study of energy savings by heat recuperation in air-conditioning systems. Final report.** Cormmelin, R.D.; van Schijndel, L.L.M.; Heeren, J.W.J.; de Boer, J.; Sulilatu, W.F. (Nijverheidsorganisatie TNO, Delft (Netherlands)). 1980. 100p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Measurements were made in each of two types of heat recovery systems. Measurements in installations equipped with liquid-coupled heat exchangers were made during the winter. Measurements in the installation equipped with a regenerator were made in springtime. From the results of the measurments heat transfer rates and thermal efficiencies were calculated. The thermodynamic performance of each type of heat recovery systems is illustrated by means of psychrometric charts (Mollier diagrams). Efficiencies of both heat recovery systems under varying outdoor conditions were obtained. Average efficiencies and savings of fuel consumption between 30 and 50% can be expected.

40943 **(EUR—7385-EN) Basic characteristics for low-cost houses in order to reduce the enrgy consumption for heating: link programme - coordination and consequences for the architectural design. Final report.** Dupagne, A. (Liege Univ. (Belgium)). 1981. 24p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The purpose of the research is to produce a Design Guide to allow an architect to take into account and estimate quantitatively the energy consequences of all choices made during the design process. Research activities conducted to produce a draft design are described. The construction cost and the heating energy consumption are two main criteria. These two performances are subjected to manifold variables arising from human behavior, climate, ground conditions, and from many specific features characterizing the building itself or the appliances it contains. It is important to make a destinction between independent variables such as climatic variables and factors such as maintenance costs. These are discussed in detail.

40944 **(EUR—7388-EN) Optimisation of electrically driven heat pumps for the heating of houses with the aim of a minimum seasonal energy consumption.** O'Connor, T.G.; McGovern, J.A.; Kyne, M.F. (University Coll., Galway (Ireland)). 1981. 118p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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The purpose of the project was to optimize the design of a heat pump system for domestic space heating under northern maritime climate conditions. A study of the climate and housing stock in Ireland and the UK indicated that an air source heat pump system with an output of about 10 kW operating in the heat-only mode would be the most appropriate device. The monitoring of some commercially available air-to-air and air-to-water systems was undertaken. Laboratory studies were made into various components of the heat pump system to establish design characteristics for evaporators, compressors and defrost mechanisms in particular. To achieve a minimal seasonal energy consumption it was necessary to consider the dynamic characteristics of the heat pump system, the house to be heated, and the climate as well as the users preferences. The development of a computer program to cope with these requirements was undertaken.

40945 **(EUR—7414-EN) Experimental investigations about using the earth as a heat-storage medium and as a heat source for heat pumps. Final report.** Nievergeld, P.; Koppenol, A.; van der Brugh, J. (Nijverheidsorganisatie TNO, Apeldoorn (Netherlands)). 1981. 83p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

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To compare th TNO computer model for horizontal earth heat exchangers with a similar model developed by Laborelec (Belgium), calculations were carried out for two well-defined cases. For linear heat conduction problems there appears to be an excellent agreement between the results obtained with the two models. In order to verify the TNO computer model under practical conditions such as prevail in the Netherlands, an experimental investigation was carried out. For this purpose two heat exchangers were installed in the earth: a single horizontal tube, at a depth of 1.5 m, with a length of 20 m; and a horizontal tube bundle, at a depth of 1.5 m, with a total effective tube length at 260 m and a tube-to-tube distance of 1 m. To get an impression of the performance of a vertical earth heat exchanger in comparison with a horizontal one, a single vertical tube consisting of 2 parallel tubes with a length of 10 m each also was installed in the earth. Measurements were carried out, independent of any particular heat pump system, during a full heating season and the summer period following this from 1 October 1979 till 1 October 1980. In total there were 118 measuring points which were automatically scanned at regular time intervals. It can be concluded from the investigations that for horizontal earth heat exchangers there is a good agreement between measured and calculated heat flows and earth temperatures, provided the effect of soil freezing is taken into account. It appears that, at the

same average fluid temperature, the single vertical tube extracts about twice as much heat from the earth as the horizontal tube bundle per running meter of tube. It is also concluded from the measurements that in summer the temperature recovery of the earth near the tube bundle and near the single vertical tube is almost complete.

40946 **(LBL—13931) Relating productivity to visibility and lighting.** Clear, R.; Berman, S. (Lawrence Berkeley Lab., CA (USA)). Jan 1982. Contract W-7405-ENG-48. 24p. (CONF-820141—1; EEB-L—82-03). NTIS, PC A02/MF A01. Order Number DE82008598.

From Public Works Canada symposium; Ottawa, Canada (25 Jan 1982).

The problem of determining the appropriate light levels for visual tasks is a cost-benefit problem. Existing light level recommendations seriously underweight the importance of economic factors. Furthermore, the relative importance of the visibility factors in determining the optimal light levels appears inconsistent with the importance of these factors in determining visibility and visual performance. It is shown that calculations based on acuities give a lower limit of 100 to 200 lux for cost-effective light levels for office tasks. Upper limits are calculated from correlations of task performance to visibility levels. Visibility levels become progressively insensitive to luminance as luminance increases. Average power densities above 100 watts/m^2 are cost-effective only when visibility is very low. However, there is a 3-to-10 times larger increase in benefits from improving contrast or contrast sensitivity than from using more than 10 watts/m^2. Contrast or contrast sensitivity can be improved by using forms with larger print, using xerographic copy instead of carbon or mimeo, making sure office workers have the right eyeglasses, or even by transferring workers with visual problems to less visually demanding tasks. Once these changes are made it is no longer cost-effective to use more than 10 watts/m^2. This conclusion raises serious questions about recommendations that lead to greater than about 10 watts/m^2 of installed lighting for general office work.

40947 (LMF—91, pp 511-514) **Formaldehyde release from formaldehyde containing products.** Griffis, L.C.; Pickrell, J.A.; Hobbs, C.H. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The relative contribution of different consumer products to release of formaldehyde vapor into the indoor environment was investigated because of concern over its potential carcinogenicity. The overall offgassing rate coefficient of CH_2O from particle board over several weeks in a desiccator did not change as the material absorbed water vapor. The inverse of the formaldehyde offgassing rate coefficient for particle board (μg/g/day) was linearly related to desiccator loading (1 to 42 m^2/m^3). Representative pressed wood products were shown to have higher offgassing rates with lower loadings. At loadings of 0.25 m^2/m^3 offgassing would be approx. 5 to 20 x greater than the rates determined at a more conventional loading of 21 m^2/m^3. In desiccators, clothes, insulation products, paper products, fabric and carpet had less than 5% of the offgassing rate coefficient of pressed wood products.

40948 (LMF—91, pp 525-529) **Toxicity of small glass fibers. II. In vitro and in vivo response to man-made mineral and asbestos fibers.** Pickrell, J.A.; Hill, J.O.; Carpenter, R.L.; Hahn, F.F.; Rebar, A.H. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The relative in vitro and in vivo toxicity of fibers from several types of glass microfiber and household insulation and Crocidolite asbestos were investigated. In vitro cytotoxicity to pulmonary alveolar macrophages indicated glass microfiber insulation to be more toxic than household insulation but less toxic than Crocidolite asbestos. To screen for in vivo pulmonary toxicity, fibers were administered in divided doses to male Syrian hamsters by intratracheal instillation and animals sacrificed at 1, 3.5 and 11 months after initial administration of fibers. Exposures to 6 mg of asbestos, 2 mg of glass microfibers and 17 to 21 mg of household insulation fibers resulted in increases in total lung collagen and mild pulmonary fibrosis. Asbestos insulation produced the greatest response. In contrast, inhalation exposure to achieve ~ 175 μg of glass deposited in lung after 5 days of exposure (< 10% of the amount instilled) produced no significant biological changes at 1 to 12 months after exposure.

40949 **(NP—2750069) Order No. 374 of 22 Jul 1981 about limitation of energy consumption in buildings.** 22 Jul 1981. 6p. (In Danish). Risoe Library, DK-4000 Roskilde, Denmark.

According to the decision of the Danish government all kinds of energy-saving measures in residential and administrative buildings can be partially subsidized, if the improvement of heat-balance is confirmed by municipal authorities. Thermal insulation of roofs, floors and walls, regulation of heating systems, introduction of district heating etc. can be subsidized.

40950 **(NP—2750070) Law No. 301 of 10 June 1981 on limitation of energy consumption in buildings.** 10 Jun 1981. 5p. (In Danish). Risoe Library, DK-4000 Roskilde, Denmark.

The objective of the law about limitation of energy consumption is to promote insulating, energy saving, modernisation of windows, doors and heating systems in residential houses with help of state subsidies.

40951 **(NP—2903788) Energy report.** (National Conference of State Legislatures, Denver, CO (USA)). 14 Mar 1980. 15p. National Conference of State Legislatures Energy Program, 1125-17th Street, Suite 1500, Denver, CO 80202 $3.00.

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Energy information reports from the National Conference of State Legislatures are presented. Information on retrofitting residential buildings (energy-conserving, legislative, and economic aspects) is included. Forty-eight publications available free of charge to state legislators and staff are listed.

40952 (NZERDC-P—36, pp 1.1-1.57) **Heating performance of air-air heat pumps.** Carrington, C.G.; Offen, R.J.; Sandle, W.J.; Meyer, L. (Otago Univ., Dunedin, New Zealand). Mar 1980. NTIS (US Sales Only), PC A06/MF A01.

In Heat pump research in New Zealand. Progress reports.

Progress is reported on monitoring the heating performance of existing commercially manufactured heat pumps, reappraising existing calculations for optimum heat exchanger sizing, and investigating the performance of an air-to-air heat pump sized and constructed for optimum long term economic performance design information. Two heat pumps were monitored using multi-point recorders and (for one of the heat pumps) a magnetic tape recorder data logger designed and built under contract support. Statistical information on heat pump operation is presented and heat pump performance to date is appraised. Seasonal coefficients of performance of not less than 2.1 and 2.3 are estimated from the data. Expected annual electricity savings are 4763 kWh and 6695 kWh. Design modifications are suggested which may well increase the seasonal coefficient of performance to 3 and need not necessarily involve increased first cost. Heat pumps costing (estimated) $1000 with a coefficient of performance of 3 are expected to be economically attractive.

40953 (NZERDC-P—36, pp 3.29-3.49) **Use of heat pumps for domestic heating.** Glover, A.J. (Auckland Univ., New Zealand). Mar 1980. NTIS (US Sales Only), PC A06/MF A01.

In Heat pump research in New Zealand. Progress reports.

Measurements were made of the heating performance of two air-to-air, and one water-to-air heat pump, to determine their economic viability and energy saving potential. These had seasonal performance factors of 1.7, 2.3, and 2.7. Only one unit showed an economic advantage over electric resistance heating and this was largely due to very favorable operating conditions. Annual energy savings of 2500, 3700, and 4400 kWh were achieved for the three units. The report shows that, from the consumer's point of view, the economic viability of the heat pump is most sensitive to its capital cost. The report also shows that the largest national energy sav-

ings would be achieved by widespread installation in the Wellington climate region.

40954 **(P—400-80-003) Regulations establishing energy-conservation standards for new residential buildings.** (California Energy Resources Conservation and Development Commission, Sacramento (USA)). Feb 1980. 40p. California Energy Commission, 1111 Howe Ave., Sacramento, CA 95825.

Portions of document are illegible.

The text of the California Administrative Code, Title 24, Part 6, Article 1 is presented. The energy conservation standards described apply to all new hotels, motels, apartment houses, lodging houses, dwellings, and other residential buildings which are heated or mechanically cooled. Standards for the building envelope, climate control systems and equipment, and water heating are included. (MCW)

40955 **(PB—81-133829) Weatherization investment costs for low-income housing. Final report.** Weber, S.F.; Boehm, M.J.; Lippiatt, B.C. (National Engineering Lab. (NBS), Washington, DC (USA)). Nov 1980. 83p. NTIS, PC A05/MF A01.

This report presents the results of a project involving the collection and tabulation of field data on the costs of retrofitting low-income houses for energy conservation. The program involves the installation and evaluation of a broad range of energy conservation techniques for over 200 single-family houses in 14 demonstration sites throughout the United States.

40956 **(PB—81-185217) A builder's guide to water and energy.** Dwight, L.P.; Seifert, R.D. (Alaska Univ., Fairbanks (USA). Inst. of Water Resources). Aug 1980. 93p. (IWR—100). NTIS PC A05/MF A01.

This Guide was designed to aid those who are developing or improving a piece of property in Alaska. It will also be useful to those considering investing in Alaskan property, especially those building in urban/suburban areas. Information on water and energy, while theoretically available to the Alaskan home builder and property developer, has been difficult to glean from the widely diverse sources. The Guide discusses this variety of planning considerations - ranging from the selecting of a lot to the fine points of energy conservation - in the chronological order needed by the builder. Topics include selecting the actual building site, water access, sewage disposal, energy access, energy conservation, tax credits, and government regulations. The Guide provides step-by-step assistance for developing a site and building upon it, while taking maximum advantage of a site's best characteristics and minimizing its shortcomings.

40957 **(PB—81-185688) A commentary on the instrumentation for building energy monitoring and control systems (EMCS). Final report.** Kao, J.Y.; Baker, D.W. (National Bureau of Standards, Washington, DC (USA)). Sep 1980. 28p. (NBSIR—80-2104). NTIS PC A03/MF A01.

This paper reviews sensors generally used for building energy monitoring and control systems (EMCS). The sensor operating principles, performances, calibration, maintenance, installation precautions, failure modes and their suitability for building EMCS use are discussed. Sensors covered in the paper include orifices, flow nozzles, Venturis, vortex shedding meters, and turbine meters for flow measurements, liquid-in-glass thermometers, resistance thermometers, and thermocouples for temperature measurements, and salt-phase transition hygrometers, impedance hygrometers, and dimensional change hygrometers for humidity measurements.

40958 **(PB—81-198053) Institutional barriers to energy conservation in Mitchell-Lama housing.** Baldwin, F.D. (Baldwin (Fred D.), Carlisle, PA (USA)). Oct 1980. 57p. NTIS, PC A04/MF A01.

This report analyzes institutional obstacles to conserving energy in 283 state-assisted housing projects, commonly known as Mitchell-Lama housing, for lower-income and middle-income households in New York State. Some of the problems discussed are common to most multi-family housing, such as inadequately trained building superintendents; others involve factors directly related to the Mitchell-Lama program's history, such as tax shelters that weaken owner incentives to invest in energy conserving improvements.

40959 **(PB—81-805491) Heat pumps. 1964-March, 1981 (citations from the NTIS data base). Report for 1964-March 1981.** (National Technical Information Service, Springfield, VA (USA)). Apr 1981. 292p. NTIS PC N01/MF N01.

Technical and economic feasibility of extracting heat from one temperature source and delivering the thermal energy extracted for use at a higher temperature is discussed in abstracts of Federally-sponsored research. Air to air, air to water, and water to water heat pump systems are covered with reference to residential, commercial, and industrial applications. Performance and reliability studies of heat pumps, including solar assisted heat pumps, for residential heating are emphasized. (This updated bibliography contains 333 citations, 105 of which are new entries to the previous edition.)

40960 **(PB—81-805509) Heat pumps. 1978-March, 1981 (citations from the Engineering Index Data Base). Report for 1978-March 1981.** (National Technical Information Service, Springfield, VA (USA)). Apr 1981. 242p. NTIS PC N01/MF N01.

Design, performance, and applications of heat pumps are discussed in abstracts from worldwide literature. The heat pumps, which extract heat from one temperature source and deliver the extracted heat for use at a higher temperature, are discussed with regard to their energy conserving potential in residential, commercial, and industrial applications. Air to air, air to water, and water to water heat pump systems are covered. The use of heat pumps, including solar assisted heat pumps, in heating and cooling of buildings and heating of swimming pools is emphasized. (This updated bibliography contains 333 citations, 173 of which are new entries to the previous edition.)

40961 **(PB—82-106105) Building technology project summaries, 1980-1981.** Raufaste, N.; Olmert, M. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Jul 1981. 89p. NTIS, PC A05/MF A01.

The mission of the Center for Building Technology (CBT) is to increase the usefulness, safety, and economy of buildings through the advancement of building technology and its application to the improvement of building practice. CBT's research activities support the building technology programs of Federal, State, and local governments; assist the design professions, building officials, and the research community by developing improved design criteria; and assist manufacturers of building products by developing methods for evaluating innovative materials, components, and systems. CBT provides an objective source of technical information for national consensus standards and model code organizations. Close cooperation with these groups leads to standard practices that meet the needs of the regulatory authorities of State and local governments. Research providing the knowledge for these standard practices is conducted in cooperation with Government, university, and industry laboratories. This report summarizes CBT's research for 1980-1981. Each summary lists the project title, its progress, point of contact within CBT, and sponsor.

40962 **(PB—82-800087) Heat loss detection of buildings. 1964-August, 1981 (Citations from the NTIS Data Base). Report for 1964-Aug 81.** (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 108p. NTIS PC N01/MF N01.

The citations in this bibliography describe various methods for displaying or determining heat loss in residential buildings, commercial buildings, and house trailers. These methods disclose sources of heat loss such as structural defects, moisture spots, and other anomalies in building envelopes. Thermography, infrared detection, tracer gases, time-response methods, and statistical predictions are among the methods used for heat loss determination. (This updated bibliography contains 100 citations, 22 of which are new entries to the previous edition.)

40963 **(PB—82-800608) Energy conservation throughout building design. 1970-August, 1981 (Citations from the Engineering Index Data Base). Report for 1970-Aug 81.** (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 206p. NTIS PC N01/MF N01.

Citations from worldwide literature on energy conservation through design of both residential and non-residential buildings are discussed. Topic areas cover solar radiation considerations in building planning and design, daylighting and window design, use of computer graphics for buildings, and architectural design concepts. (This updated bibliography contains 200 citations, 50 of which are new entries to the previous edition.)

40964 **(PLRD—82-47) Building energy-analysis computer programs developed by federal agencies - cost, use, and need.** (General Accounting Office, Washington, DC (USA)). 22 Mar 1982. 26p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

An examination was made of building energy analysis computer programs to determine the total cost to the government to develop these programs; to determine the uses being made of these programs; to investigate the rationale for selecting a government-developed program as the Building Energy Performance Standards evaluation technique for calculating energy consumption in buildings; and to determine if there is a continuing need for the government to develop these types of computer programs. Seven energy analysis computer programs developed with federal funds were examined. Only two of the programs are used with any degree of frequency and the General Accounting Office recommends that these funding efforts be terminated. (MCW)

40965 **(PNL-SA—10230) Commercial building design and energy conservation: a preliminary assessment.** Nieves, A.; Rosoff, D. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1982. Contract AC06-76RL01830. 13p. (CONF-820217—2). NTIS, PC A02/MF A01. Order Number DE82008581.

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

The purpose of the research was to determine the degree of change in commercial building design practice relating to energy conservation since the enactment of the Energy Conservation Standard for New Buildings Act of 1976. Data on current design practices consisted of information from 400 buildings advertised for bids or under construction in 1979 to 1980 on glass in windows and doors, exterior wall systems, roof system, heating plants, and lighting systems. In addition to these building design components, energy conservation measures used included: natural lighting; deadband thermostat; greenhouse-effect atrium collector, heat recovery from the top of the atrium, greenhouse passive heating panels; natural ventilation; insulating shutters, closable skylights, thermal shutters, Trombe wall, corridor trombe; attic ventilation; wind shielding, concrete wall; titlted windows; night flushing cycle; and cooling coils using cooling tower water. A brief explanation of these measures is given. (MCW)

40966 **(SSEC/SP—32288) Energy considerations: mobile homes in the South.** Tilt, G.R. (Southern Solar Energy Center Planning Project, Atlanta, GA (USA)). Nov 1981. Contract AC02-79CS30166. 22p. NTIS, PC A02/MF A01. Order Number DE82009586.

Mobile homes in the Southern region are discussed and their relationship to residential energy conservation is examined. Some of the research being done in energy conservation and solar energy applications for manufactured houses is examined. A bibliography is included. (MCW)

40967 **(SSEC/TP—41300) Residential heating and cooling loads and costs for the South.** Lau, A.S.; Hyatt, T.D. (Southern Solar Energy Center Planning Project, Atlanta, GA (USA)). Jan 1982. Contract AC02-79CS30166. 29p. NTIS, PC A03/MF A01. Order Number DE82009504.

Portions of document are illegible.

This report examines typical residential heating and cooling loads for 24 southern cities and six other US cities. A 1536-square-foot house is examined, with concrete slab floor, frame construction, ventilated attic, and glazing area equivalent to 12% of the floor area. Five basic variations of this house were analyzed: two insulation levels with two compass orientations each, and a sun-tempered case. The building load calculations were based on a non-rigorous methodology typically used within the building community today. The estimated heating and cooling loads and the impact of insulation, orientation, and sun-tempering are illustrated with regional maps. Typical fuel costs and heating systems are also examined and shown to have a major role in determining whether the building design emphasis should be on heating or cooling.

40968 **Barriers to the adoption of an energy-efficient technology.** Marcus, A.A.; Sommers, P.; Berk, B. (Battelle Human Affairs, Research Centers, Seattle). *Energy Policy;* 10: No. 2, 157-158(Jun 1982). Contract AC06-76RL01830.

Solid-state electronic ballasts promise significant energy savings in the lighting systems of large buildings. However, organizational factors and standard operating procedures may inhibit the adoption of this technology in the large, bureaucratic public- and private-sector organizations that represent the major potential users of this technology.

40969 **Optimization of double hollow slab for maximum thermal load levelling.** Sodha, M.S.; Kumar, A.; Srivstava, A.; Aiwari, G.N. (Indian Inst. of Tech., New Delhi). pp 183 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40970 **Principles for the non-mechanical cooling of buildings.** Bowen, A. (Univ. of Miami, Coral Gables, FL). pp 189 of Solar cooling and dehumidifying. Martinez, A.R. (ed.). Oxford, England; Pergamon Press Ltd. (1981).

From 1. international solar cooling and dehumidifying conference; Caracas, Venezuela (3 Aug 1980).

40971 **Feasibility of a European model code for saving energy in space heating.** Blachere, G.; Neirac, F.P. Luxembourg; Commission of the European Communities (1981). 250p. (EUR—7439-DE-EN-FR-IT). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037 $17.50.

The object of this study is to review the various measures for reducing heating energy requirements or for satisfying them from European or unrenewable sources, and thus to arrive at a draft European model code and other conclusions regarding Community action in the sphere of standardization and research. Memoranda are presented in which means of saving energy are examined. Subjects covered are: reduction of heating energy requirement, measures regarding buildings and their installations, and energy substitution. Each memorandum is divided into the following sections: examination of the substance of the proposed economy measure; cost and effectiveness of the measure; limitations of the measure, particularly because of its effect on the satisfaction of the user's other requirements; application of the measure to existing and/or new buildings; industrial and commercial consequences; current use made of this measure in the Community countries; and proposals for Community action. Proposals and conclusions are presented and a draft model code is contained in the annex.

40972 **House as a system.** pp 5-15 of Rational use of energy. London, England; Watt Committee on Energy Ltd. (1978).

Three kinds of energy expenditures in a house are discussed. These are for non-thermal uses, high and low temperature uses, and space heating use. Space heating dominates the use of energy; the requirements, the equipment, and the energy balance of space heating are discussed in detail. (MCW)

40973 **(PB—81-217374) Technological-economic study of selected vitreous coatings deposited on a transparent conductor for the thermal insulation of buildings.** (Commission of the European Communities, Luxembourg). [nd]. 73p. (EUR—6804-FR). NTIS PC E04/MF E04.

The aim of the research project was to study systematically the optimisation of coatings of indium oxide (In2O3) doped with tin and of coatings of tin oxide (SnO2) and to compare their cost and product quality. The oxides of indium and tin were deposited on a glass substrate by the Pyrosol process.

3202 Transportation

REFER ALSO TO CITATION(S) 41058, 41458

40974 **(PB—81-126385) Effects of road design and traffic conditions on vehicle operating costs. A study of the literature. Report VTI-154.** Hammarstroem, U.; Ericsson, T. (National Swedish Road and Traffic Research Inst., Linkoeping). 1978. 150p. (In Swedish). NTIS, PC A07/MF A01.

Road planning requires knowledge of connections between maintenance and construction of roads and vehicle costs. The Swedish Road Administration is continuously improving the knowledge of these connections. As a part of this work the Swedish Road and Traffic Research Institute (VTI) was commissioned to perform a study of the literature to survey the state of the art. The connections between maintenance and construction of roads and vehicle costs consist of two steps. Maintenance and construction influence the road and traffic conditions which affect vehicle costs. The connections between maintenance and construction and the road and traffic conditions are presupposed to be known or surveyed elsewhere. Consequently, this study is limited to the connections between vehicle costs and road and traffic conditions.

40975 **(PB—81-145104) Cost and economic impact of tire reserve load requirements. Final report, July-October 1980.** Viergutz, O.; Marek, S.; Kelley, C.; Wakeley, H. (IIT Research Inst., Chicago, IL (USA)). Oct 1980. 100p. NTIS, PC A05/MF A01.

Inadequate maintenance of proper tire inflation by consumers and low tire reserve loads by auto manufacturers have contributed to unsafe driving conditions and tire failure. This report assesses the cost and economic impact of increased minimum tire reserve load requirements on the auto and tire industries, and the feasibility of regulation implementation for 3, 5, 7, 10, and 12% tire reserve loads. These are analyzed for the years 1981 through 1984. The costs and projections are based on the conditions found in the 1980 vehicle fleet and tire population and upon industry projections of future conditions.

40976 **(PB—81-182420) Transportation energy contingency plan for the Kansas City Metropolitan Region. Final report, July 1978-February 1980.** (Mid-America Regional Council, Kansas City, MO). Feb 1980. 96p. NTIS PC A05/MF A01.

The purpose of the Plan is to study and recommend strategies which provide persons residing in the KCMR with energy efficient alternatives for traveling to work during a transportation fuel crisis, and focuses on strategies which protect passenger transportation and the work trip and reduce the demand for transportation fuel. Over fifty transportation control measures were studied.

40977 **(PB—81-187460) Consumer behavior towards fuel efficient vehicles. Volume IV: operating instructions and program documentation for the CS vehicle choice simulation model. Final report, October 1977-September 1980.** Ginn, J.R.; Berkovec, J.A. (Cambridge Systematics, Inc., MA (USA)). Sep 1980. 109p. NTIS PC A06/MF A01.

The report assesses consumer behavior towards fuel-efficient vehicles designed to meet recently mandated federal fuel economy standards. The study involves a comprehensive evaluation of existing nationwide survey data as well as the development of a major new econometric forecasting model of household vehicle type choice. As a result, the report describes both an assessment of consumers' current reported sentiments toward fuel-efficient vehicles and insights into expected future changes in household vehicle purchase behavior in response to changes in vehicle designs and prices, demographics, and the energy environment.

40978 **(PB—81-188195) Methods for analyzing fuel supply limitations on passenger travel. Final report.** Tardiff, T.J.; Benham, J.L.; Greene, S. (Charles River Associates, Inc., Boston, MA (USA)). Dec 1980. 142p. NTIS PC A07/MF A01.

The report describes the development and testing of methodologies for analyzing the travel impacts of fuel supply limitations. Quantitative approaches are used to analyze work and nonwork travel. The work trip analysis combines incremental logit analysis with the traveler classification aggregation approach. The nonwork trip analysis is based on linear VMT and transit trip models. Input data and computational requirements are modest. The quantitative forecasting system was applied to several fuel shortfall scenarios and produced reasonable results. Qualitative analysis was used to refine the assessment of work and nonwork travel responses, to analyze long-run impacts such as residential location and auto ownership changes, and to evaluate the distribution of impacts across income or geographic groups.

40979 **(PB—81-190977) Individual manufacturer procedures to establish fuel economy adjustment factors. Final report.** Kaufman, S. (Falcon Research and Development Co., Buffalo, NY (USA)). Feb 1981. 91p. NTIS PC A05/MF A01.

The EPA is considering developing procedures for manufacturer-specific adjustment factors for EPA fuel economy labeling: both vehicle design adjustment factors as well as in-use road adjustment factors. These procedures could be followed by a manufacturer if it feels that the adjustment factors provided by EPA regulations are not appropriate for its own vehicles. This report addresses the question of automotive vehicle fuel economy as influenced by selected vehicle design parameters and by conditions which differentiate the on-road environment from the test environment. The central thrust of the report is the formulation of applicable fuel-economy adjustment factors in the context of a specific manufacturer's product line.

40980 **(PB—81-196743) Augmenting in-use fuel economy data bases with topographic, demographic and climatic data. Final report.** Gins, J.; Furutani, C.; Rakuljic, G. (Technology Service Corp., Santa Monica, CA (USA)). Apr 1981. 100p. NTIS PC A05/MF A01.

The EPA asked Technology Service Corporation (TSC) to augment several in-use fuel economy data files with information on the climatic, topographic, and demographic conditions under which the in-use data were collected. This report describes the type of variables and data sources added to the in-use data, the method for augmenting specific in-use data files, and how the appended data were analyzed to determine vehicle exposure regions. In-depth information about the in-use fuel economy data is not provided in this report.

40981 **(PB—81-203333) Update on the fuel economy benefits of inspection and maintenance programs. Technical report.** Michael, R.B. (Environmental Protection Agency, Ann Arbor, MI (USA). Inspection and Maintenance Staff). Apr 1981. 29p. NTIS, PC A03/MF A01.

The purpose of this report is to present an updated assessment of the fuel economy benefits of Inspection and Maintenance (I/M) programs, in terms of individual vehicle and fleetwide savings, using the latest EPA test data. The fuel economy benefits which will result from a basic I/M program and the incremented benefits due to adding options to the basic program are presented. The basic of 'typical' I/M program analyzed is an annual one with idle emissions inspections of all gasoline powered passenger cars of model years 1968 and newer. The three options which are analyzed are a more effective test for 1981 and later vehicles, a mechanic training program, and a tire pressure check conducted as part of the I/M inspection.

40982 **(PB—81-203507) FMVSS No. 208 extension to light trucks, vans, and mpv's - cost/leadtime study. Final report Feb-Jun 80.** Schwarz, R. (South Coast Technology, Inc., Dearborn, MI (USA)). 6 Feb 1981. 100p. NTIS, PC A05/MF A01.

Design studies were made of the vehicle modifications required to accommodate air bags and passive belt restraint systems in full-sized pickup trucks, vans, and mini-pickups. Costs and weights of these modifications were estimated for both types of restraint systems, as well as the impact of the additional weight on fuel consumption. The leadtime for incorporating these modifications into production vehicles was also estimated. It was concluded that the retail price increment for the vehicle modifications would be in the range from $47 to $56 for a passive belt system, and $54-$73 for an air bag system.

40983 **(PB—81-206617) Energy efficiency in passenger and goods traffic in Sweden - a comparative analysis.** (Transportforskningsdelegationen, Stockholm (Sweden)). Feb 1979. 70p. (In Swedish). NTIS, PC A04/MF A01.

The most widely used means of transportation in Sweden have been compared as regards energy use for propulsion, manufacturing and maintenance of materials and for construction and maintenance of infrastructure. The analysis applies to the 70's and includes conversion losses. The results do not unequivocally show which means of transport that uses energy most efficiently. Generally, efficiency increases in line with capacity utilization. More interesting is that efficiency shows a clear relation to transport capacity (air transports excluded), thereby providing economies of scale - assuming equal load factors. After including energy for material and infrastructure in the analysis, the efficiency-ranking of various means of transportation is unaltered. These two factors consume between 5% (air transport) and 35% (railroads) of total energy use for that means of transportation. Substantially higher numbers - even exceeding 50% - are noted where roads and railroads are sparsely used. A wide range of variations is noted for passenger traffic in urban areas both within and between various means of transportation. During rush hours economies of scale are gained through high capacity utilization, whereas low capacity per trip provides the best results in non-rush hours. For hauling of goods in urban areas there is no realistic alternative to trucks, but efficiency is low due to the character of activity. In general, the study shows that energy efficiency varies greatly in relation to varying circumstances. Consequently, the best mix of transport systems should be sought, rather than the one most efficient.

40984 **(PB—81-206625) Energy efficiency in passenger and goods traffic in Sweden - a comparative analysis. Appendix.** (Transportforskningsdelegationen, Stockholm (Sweden)). Feb 1979. 222p. (In Swedish). NTIS, PC A10/MF A01.

The three appendices contain background material to the main report. Appendix A shows the sampling of vehicles etc. and how direct energy use varies within different means of transport. Furthermore, it shows energy use for manufacturing and maintenance of vehicles. Finally, energy use is re-estimated after taking conversion losses etc. into consideration. Appendix B treats energy use in relation to construction and maintenance of infrastructure. Also in this case the results are recalculated into 'crude oil equivalents'. Appendix C discusses the principles for energy conversion that are used in appendices A and B. It also analyzes energy consumption in the production of materials. Furthermore, specifications of materials are presented. (In appendix A the total energy use is estimated, taking into consideration specification, production and average waste of materials, assembling of parts etc.) Energy consumption is given in the form of electricity or as non-renewable fuels. Only final results are recalculated into crude oil equivalents. If not otherwise stated, all figures relate to the mid-70's.

40985 **(PB—81-206658) Air resistance of trucks - a literature inventory.** Odsell, O. (Statens vaeg- och Trafikinstitut, Linkoeping (Sweden)). 1979. 66p. (In Swedish). NTIS, PC A04/MF A01.

Reducing a vehicle's air resistance is one important way to reduce fuel consumption. This report compiles results from studies, primarily foreign, of the air resistance of trucks. As a background an introduction into theories is given and different methods of measuring air resistance are presented. Finally, an assessment of appropriate ways to reduce air resistance for trucks in Sweden is made. Air resistance bears a linear relation to the front area of the truck, and a quadratic relation to speed. So speed is very important, but one must also consider the type of vehicle, its load and driving conditions. One method to estimate the effects of measures to reduce air resistance is to compare fuel consumption before and after. However, this method is generally not very accurate. The air resistance coefficient for a truck today lies in the range 0.8-1.2, but it is considered possible to halve these figures in the future. 70 percent of air resistance is attributed to the front of the truck. The only fittings presently produced for commercial use are air diverters to be installed on the roof of the cab. These may save around 4 percent of present fuel consumption and are profitable to buy and use at present fuel prices. A voluntary savings program is presently under way in Sweden. One important part of this will be to test (scientifically) new products, stated to save fuel.

40986 **(PB—81-238628) Transportation system management, air quality, and energy conservation.** (Public Technology, Inc., Washington, DC (USA); Department of Transportation, Washington, DC (USA)). Sep 1980. 85p. NTIS, PC A05/MF A01.

This is one of ten bulletins in the fourth series of Information Bulletins produced by the Transportation Task Force of the Urban Consortium for Technology Initiatives. Each bulletin in this series addresses a priority transportation need identified by member jurisdictions of the Urban Consortium. Nine newly identified transportation needs are covered in this fourth series of Information Bulletins. They are economic impacts of transportation restrictions, parking and traffic enforcement, pedestrian traffic safety, school bus use for non-school transportation, street management information systems, taxicabs as public transit, transportation construction management, transportation of hazardous materials, and transportation system management, air quality, and energy conservation.

40987 **(PB—81-240467) Automotive fuel economy - potential improvement through selected engine and differential gear lubricants. Final report.** Naman, T.M. (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). Jul 1981. 50p. NTIS, PC A03/MF A01.

This report evaluates the effects of four engine lubricants and three differential gear lubricants on the fuel economy of two 1978 automobiles operated at 20F, 70F, and 100F ambient temperatures. The engine lubricants were evaluated using the 1978 Federal Test procedure and steady state tests from a cold start. The gear lubricants were evaluated in steady state operation from a cold start.

40988 **(PB—82-853755) Marine fuels. January, 1973-October, 1981 (citations from Information Services in Mechanical Engineering Data Base). Report for Jan 73-Oct 81.** (National Technical Information Service, Springfield, VA (USA)). Oct 1981. 67p. NTIS PC N01/MF N01.

Citations in this bibliography cover research and experimentation, fuel system design, future demands, contrast and comparisons, and applications of various marine engine fuels and lubricants. Residual fuel oils, coal powered steam propulsion, homogenizing and treating fuels, electrical power, gas turbines, waste exhaust heat-energy recovery systems, exhaust emissions, conservation, and nuclear fuels are among the topics discussed relevant to marine engine fuels and fuel systems. Developments in fuels and their effects on power plant wear are included. (Contains 74 citations fully indexed and including a title list.)

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 40150, 40153, 40366, 40374, 40375, 40376, 40377, 40708, 40959, 40960, 41042, 41046, 41046, 41047, 41047, 41085, 41279

40989 **(AD-A—102743/2) Fabrication and demonstration of an integrally heated and pressurized mold system. Final report Jul 79-Oct 80.** Anderson, R.G.; Blake, E.E. (Bell Helicopter Textron, Fort Worth, TX (USA)). Mar 1981. 111p. NTIS, PC A06/MF A01.

The objectives of this research program are to reduce tooling costs for a composite tail rotor blade; reduce bond cure cycle time spans; and realize energy savings when compared to the conventional autoclave cure system. A thermally efficient mold bond

insert and structure was designed and fabricated. Three bearingless tail rotor blades for a light helicopter were manufactured.

40990 **(DOE/CS/40071—22) Direct enzymatic extraction of starch from corn as an energy-saving alternative to production of high-fructose syrup. Quarterly progress report, July 1, 1981-September 30, 1981.** (Purdue Univ., Lafayette, IN (USA). Lab. of Renewable Resources Engineering). 1981. Contract AS02-78CS40071. 8p. NTIS, PC A02/MF A01. Order Number DE82009388.

Progress is reported on the project to extract starch from corn efficiently. The procedure for removing organic impurities from corn syrup is described. Data are graphically shown of the ultraviolet scan of the dirty and clean syrup. Impurity in the glucose syrup could be reduced from 0.51 gm/ml level using the sedimental method down to 0.23 mg/ml by filtering the syrup through diatomic earth filter. The industrial products contain about 0.37 mg/ml (industrial product also filtered through diatomic earth filter). (MCW)

40991 **(DOE/CS/40350—T1) In-plant demonstration of a Machnozzle as a fabric-predrying device. Final report.** Carr, W.W.; Holcombe, W.D.; Robertson, S.D.; Carter, W.C. (Georgia Inst. of Tech., Atlanta (USA)). Oct 1981. Contract AS05-80CS40350. 129p. NTIS, PC A07/MF A01. Order Number DE82010892.

The objective of the project was to demonstrate on a commercial scale the Machnozzle as a predrying device for fabrics. The report documents the in-plant demonstration and includes a review of the pilot-scale research; a description of the in-plant demonstration and methodology used; results of the Machnozzle tests energy recovery tests, and fabric quality assessment tests; and an economic analysis of the Machnozzle as a predrying device with and without energy recovery. (MCW)

40992 **(DOE/CS/55219—T1) Energy-efficient transport refrigeration systems for fresh meats. Final report.** Hoke, K.E.; Melby, E.E.; Craig, W.L. Jr.; Minning, W. (Department of Agriculture, Beltsville, MD (USA)). Feb 1982. Contract AI01-78CS55219. 49p. NTIS, PC A03/MF A01. Order Number DE82011421.

Twenty-four shipments of fresh beef carcasses, transported by highway from a midwest packinghouse to wholesalers in Florida, were used to study fuel consumption and meat shrinkage. Twelve shipments were transported in a trailer using four methods of refrigeration controls - standard, pump-down cycle system, modulating valve and cylinder unloaders, and a finger duct refrigerated air distribution system. The other twelve shipments were transported in a trailer equipped with standard refrigeration controls and a reversing air distribution system. The modulating valve refrigeration control and finger duct type air distribution was the most economical way to transport fresh beef. Our study indicated that compared with the standard refrigeration system, the modification employing a modulating valve is the most energy-efficient at this stage of development. The study also indicated that a reverse air modification system employed in one of the test vehicles used at least 15% more fuel than the standard units on the road, and that the air shifts did not result in [a better kept] meat arriving in a better condition at the end of the run; nor did the reserve air system show any significant effect on decreasing meat shrinkage.

40993 **(EUR—6916-EN) Experimental Rankine-cycle engine designed for utilization of low-temperature, low-pressure heat. Final report.** Cipolla, G.; Margary, R. (Fiat Centro Richerche, Orbassano (Italy)). 1981. 26p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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A description is presented of the development of, and the results obtained from, a Rankine cycle engine, using Freon 11 as working fluid, aimed at the utilization of low temperature heat sources. The activities carried out in order to assess the feasibility of the engine involved: working fluid and thermodynamic cycle choice; engine and test rig design and set up; engine performance and mechanical behavior evaluation; and a laboratory investigation on chemical compatibility and thermal stability of the working fluid. The main results of the experimental investigations performed are that the engine performance is in good agreement with the calculated values; the mechanical behavior of some components is not yet satisfactory; and it has been found out that the working fluid adopted (Freon 11) has proved not to be completely reliable in the higher temperatures range. An extension of the feasibility study, mainly from the point of view of the fluid suitability, is envisaged using a fluorine compound as working fluid. To this purpose, some thermodynamic cycles have been defined, which can be performed by the current engine, without any change.

40994 **(EUR—7006-DE) Heat recovery units with reflux heat pipes as components.** Groll, M.; Nguyen-Chi, H.; Kraehling, H. (Institut fuer Kerntechnik und Energiewandlung e.V., Stuttgart (Germany, F.R.)). 1981. 148p. (In German). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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Gravity-assisted heat pipes and two-phase thermosyphons (reflux heat pipes) are excellent thermal components for heat recovery units. These units have a great energy savings potential. With respect to an economic manufacture and in order to achieve a broader application for these heat recovery units the following important research and development tasks have been performed: (1) a systematic investigation of the heat transfer and fluid-mechanic phenomena in gravity-supported heat pipes and thermosyphons and their performance limitations; and (2) an investigation of the long-term compatibility of structural materials and working fluids to determine their long-term operational behavior.

40995 **(EUR—7068-FR) Record of work on novel electrocatalysts for advanced electrolysis. Final report.** Martin, L.; Diette, J.; Prigent, M.; Bernard, M.; Demarsy, J.; Sellier, C. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison; Societe de Recherches Techniques et Industrielles (SRTI), 78 - Buc (France)). 1981. 109p. (In French). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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This study, carried out jointly by IFP and SRTI aims at obtaining an electrolytic cell with a potential around 1.6 V in the 160 to 200°C temperature range. IFP have investigated the composition of the catalysts used and methods of applying them to the electrodes. Trials of short duration have been carried out at 80°C and 1 $A.cm^{-2}$ current density; a physical-chemical examination of the electrodes has been made before and after use. SRTI have been concerned with the study of alkaline electrolysis up to 200°C in aqueous medium, the optimization of electrode geometry and the activation of the electrodes by electrochemical processes. Endurance trials of several hundred hours have been carried out. Results have shown that catalytic activation of electrodes is an efficient method of improving electrolytic output.

40996 **(EUR—7073-EN) Energy use in the food-manufacturing industry.** Whitman, W.E.; Crawford, A.G.; Elsen, C.R. (Leatherhead Food Research Association, Surrey (UK)). 1981. 182p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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The results of a survey conducted by questionnaire showed that the total energy used in the UK for the manufacture of food was of the order of 67 PJ per annum. The sector of the food industry using the highest amount of energy (24 PJ) was SIC 2112 covering milling operations other than wheat milling. The most energy intensive sectors were SIC 2171 (cocoa and chocolate industry), SIC 2292 (starch and miscellaneous products), SIC 2142 (processing and preserving of meat and fish), and SIC 2172 (sugar confectionery). Due to the low overall level of response the zone of uncertainty is considerable. A major recommendation resulting from this survey is that more effort should be devoted to demonstrating to the food industry the value of carrying out energy audits to identify areas of wasted energy. More demonstration projects also need to be set up to prove the economic feasibility of many of the available systems for heat recovery. There is a need to develop a heat pump to use low grade heat to produce hot water at 100°C or low pressure steam. Forms of motive power, other than electrical, should be

more seriously considered especially in the case of energy intensive process machinery.

40997 **(EUR—7127-EN) Development and demonstration of improved gas to gas heat. Pipe heat exchangers for the recovery of residual heat. Final report.** Davies, M.J.; Chaffey, G.H. (UKAEA Atomic Energy Research Establishment, Harwell). 1981. 49p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The proposal is for the research, development, and demonstration of improved heat pipe, extended surface, gas to gas heat exchangers. The work was aimed at increasing the present rate of installation of heat recovery systems by making economic and technical improvements that bring the equipment within the currently acceptable investment threshold. The feasibility studies, the component and prototype development, and the demonstration program are described.

40998 **(EUR—7159-EN) Experimental Rankine-cycle engine designed for heat recovery from exhaust gases of industrial plants. Final report.** Cipolla, G. (Fiat Centro Ricerche, Orbassano (Italy)). 1981. 239p. (In English and Italian). European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

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The development of, and the results obtained from, an Organic Rankine Cycle (ORC) engine in order to assess its feasibility is described. Activities carried out are: engine and test rig design and set up; working fluid and thermodynamic cycle choice; engine performance and mechanical behavior evaluation; laboratory investigation on chemical compatibility and thermal stability of the candidate working fluids. Engine performance was evaluated using two different fluids: Freon 11 and perfluorohexane. The main results of the experimental investigation performed are: engine performance is in good agreement with the calculated values; mechanical behavior of the main components is almost satisfactory; and Freon 11 has proved not to be completely reliable in the higher temperature range, but very interesting from the performance point of view. Perfluorohexane, on the other hand, has shown very good stability up to 250°C, but it is not fit for a simple non-regenerative cycle engine and very expansive. It appears that ORC engine feasibility has been demonstrated and tests carried out have shown the reliability of the analytical evaluation methods developed in order to design an ORC engine.

40999 **(EUR—7192-EN) Assessment of energy consumption and optimisation of usage in the paper industry.** Lucas, N.J.D.; Murgatroyd, W.; Ladomatos, N. (Imperial Coll. of Science and Technology, London (UK)). 1981. 96p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The aim of the project is to determine what can be learned from a statistical analysis of data on energy consumption in the paper industry. Existing data were collected and analyzed at three different levels of aggregation: the country, the production site, and the individual machine. For each level, two types of analysis were made: inter-unit comparison, and a temporal comparison within a unit. The work was complemented by three detailed physical balances on paper-making machines, a procedure usually referred to as an energy analysis. Considerable success was achieved in identifying and quantifying the structural influences on energy consumption. In this respect the different analyses illuminate each other. Despite the fact that in some instances either data were not made available or it proved inadequate for good statistical reliability, several firm conclusions can be drawn, conclusions which are significant from the point-of-view of energy management, and several recommendations are made. These are summarized.

41000 **(EUR—7279-EN) Identification of a fast accurate method of measuring the overall efficiency of industrial boilers. Final report.** Foley, M. (Institute for Industrial Research and Standards, Dublin (Ireland)). 1981. 116p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

Overall thermal efficiency is a measurement of boiler efficiency which includes the effects of load factor and varying load conditions over a given test period. The recommended method of measuring overall efficiency is based on measurements made on combustion efficiency and fuel input at regular intervals over a daily period. Test results show that Fyrite and Dwyer combustion test equipment present both a fast and accurate method of determining combustion efficiency. The aim of the research is to develop a technique of measuring overall thermal efficiency of industrial boilers based on one of the following methods: Standard Direct, according to VDI/DIN 1942 (1956); Standard Indirect, according to VDI/DIN 1942 (1956); Bacharach Fyrite combustion test kit (Indirect); and Dwyer combustion test (Indirect). The methods are described and some test results are given.

41001 **(EUR—7362-EN) Energy consumption and energy saving in the heat-setting and dye-fixation of textile fabrics on stenters. Final report.** Parish, G.J.; Reed, C.M. (Shirley Inst., Manchester (UK)). 1981. 97p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The research is concerned with the factors determining the energy consumption in the heat treatment processes and with means for reducing this energy consumption. The exhaust heat loss must be reduced. An investigation was made of the properties of the volatile impurities, their effects on conditions inside the oven, and the factors influencing their removal by recirculatory direct firing. The work concentrated on volatile spinning oils and on dyestuffs and dying auxiliaries. Laboratory investigation of the factors governing the volatilization of these substances and measurements of vapor densities were related to measurements of vapor concentrations, rates of evaporation, and air flows on a pilot scale, and a full scale senter. The combustion of the vapors were examined using a furnace tube, an electric heat element, and a gas flame. Measurements were made of calorific value and the requirements for senter heating with recirculatory direct-firing were analyzed theoretically. The analysis was extended to include alternative exhaust-combustion and heat recovery systems.

41002 **(EUR—7363-EN) Falling cloud heat exchanger: commercial pilot-plant operation. Final report.** Sagoo, M.S. (Stone Platt Fluidfire Ltd., Brierley Hill (UK)). 1981. 30p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

Tests on the Falling Cloud Commercial Pilot Plant have demonstrated that a high proportion of heat from hot exhaust gases flowing up the chimney can be recovered. Overall thermal efficiencies of up to 55% were obtained from heat recovery tests on the pilot plant. Thermal efficiencies greater than this can be achieved by improvements in the particle flow, fluidization and increasing the cooling water flow rate and plant optimization in general. The maximum gas-to-particle heat transfer coefficient was found to compare well with those obtained from an experimental rig. Heat transfer coefficients of up to 32.5 Btu/ft^{2}h°F (184.5 kW/m^{20}K) were obtained for alumina. A comparable figure for the experimental rig was 37.0 Btu/ft^{2}h°F (210 kW/m^{20}K). The gas-to-particle heat transfer coefficients for steel particles were found to compare extremely well at the higher end of the particle flow rates. Coefficients up to 51.3 Btu/ft^{2}h°F (291 kW/m^{20}K) were obtained, compared with up to 53 Btu/ft^{2}h°F (301 kW/m^{20}K) from the experimental rig. The general drop in the heat transfer coefficients at extremes of particle flow conditions have been attributed mainly to the improvement areas mentioned above. The rate of heat recovery depended largely on the particle circulation rate and was found to be fairly constant (particularly for alumina) over a range of 50 to 100% of maximum particle circulation in the plant. It was found that the heat recovery rate from the plant was up to 27% greater than that obtained from the experimental rig operating under similar conditions. This finding is of extreme commercial value to the Falling Cloud Heat Exchanger applications.

41003 **(EUR—7565-EN) Gas generation of low Btu fuel gas from agricultural residues. Final report.** (Moteurs Duvant, Valenciennes (France)). 1981. 6p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Engines using low Btu gas from agricultural wastes, installed or on order, are listed. The general technology, evacuation of residual waste and ashes, and gas purification are reviewed.

41004 **(EUR—7576-EN) Recovery of heat from exhaust air of spray driers in the dairy industry. Summary report and final report.** Jansen, A.; Steenbergen, A.E.; Bergers, W.W.A. (Netherlands Inst. for Dairy Research, Ede). 1981. 98p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The purpose of the research was to investigate how powder and moisture content of exhaust air influence the performance of air to air heat exchangers with a special veiw to low cost aluminium types. A system capable of producing several powder concentrations in exhaust air was developed. The principle and design of the system are described. Experimental results showed that the decline of the thermal efficiency was nearly the same under all tested conditions, but the increase of flow resistance was dependent on powder and moisture content of the exhaust air. A preliminary economical assessment of the influence of variable on savings was made. Conclusions are summarized.

41005 **(EUR—7642-EN) Heat recovery by organic Rankine cycle in ceramics firing ovens. Final report.** Angelino, G.; Ferrari, P.; Gaia, M.; Giglioli, G.; Macchi, E. (Gemmindustria s.n.c., Milan (Italy)). 1982. 33p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The process of ceramics firing, as well as many other high temperature processes, is highly inefficient and it is possible to recover an important fraction of the heat input. However, the recovery of heat is not practical because heat finds little use in the factory and its transport to other users is expensive. A recovery system is proposed which transforms the recovered heat into electricity by means of an Organic Rankine Cycle Engine. The produced electricity can often be utilized directly in the oven for driving the air and exhaust fans. A thermodynamic study has led to the selection of tethrachloroethylene as the working fluid, with a rated power output of 40 kW at the turbine shaft and at an evaporation temperature of the work fluid of 110°C. The construction of the engine and the installation of the plant on the oven have been completed and a number of trials have been perfected. The engine is currently operated 8 hours per day. Some experimental results, obtained in a series of tests carried out at Gemmindustria, are presented: they clearly show that all the technical goals of the research (engine efficiency, power output, behavior in transient conditions, etc.) have been met.

41006 **(PB—81-175929) Batch pretreatment process technology for abatement of emissions and conservation of energy in glass melting furnaces. Phase I. Process design manual.** Miller, R.E.; Jones, K.R.; Camacho, N.J.; Boettner, G.B.; Bruns, J.H. (Corning Glass Works, NY (USA)). Mar 1981. 317p. NTIS PC A14/MF A01.

The Environmental Protection Agency contracted with Corning Glass Works for the development of glass batch pretreatment process which would abate emissions and reduce energy usage in the melting furnace. The contract consists of two phases of work. Phase I, now completed and reported in this document, was a laboratory phase to supply the information needed to design a pilot plant system, and based on this design, to estimate the energy, pollution, and economic advantages of the program. Phase II will consist of constructing and operating a batch preheating pilot plant test facility to confirm the bench scale test results and to provide the necessary design and operating information for a full scale production facility. The Phase II results will also be used to update the energy, pollution, and economic advantages of the process.

41007 **(PB—81-176067) Proceedings of a workshop on catalytic combustion (4th) held at cincinnati, ohio on may 14-15, 1980. Report for sep 78-may 80.** Kesselring, J.P. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). Aug 1980. 561p. NTIS PC A24/MF A01.

The proceedings document the major presentations at the Fourth Workshop on Catalytic Combustion, held in Cincinnati, OH, May 14-15, 1980. Sponsored by the Combustion Research Branch of EPA's Industrial Environmental Research Laboratory (Research Triangle Park), the workshop served as a forum for the presentation of results of recent research in the areas of catalyst performance, components and applications of catalytic combustion systems, and the use of alternative fuels in catalytic combustors. The workshop provided industrial, university, and government representatives with the current state of the art in the application of catalyst systems for pollution control and performance improvement. Applications include fire tube and water tube boilers, and gas turbines for utility, industrial, automotive, and aircraft systems.

41008 **(PB—81-184236) Concept of an integrated waste economy represented on the example of recycling of valuable materials.** Wender, H. (Technische Hochschule Darmstadt (Germany, F.R.)). Aug 1980. 213p. NTIS PC A10/MF A01.

Thesis.

The historical development of waste elimination is discussed, followed by the waste problem in an environmental discussion, the possibilities of recycling within the framework of a waste industry, and the solution of the waste problem from a waste-economy viewpoint, including the definition of 'waste' and the grouping by types of waste, their amounts and increase rates, composition and valuable materials in community wastes with a review of waste technologies under waste-economy viewpoints. This is followed by a discussion of the sales possibilities for valuable components from mechanical sorting facilities, including used paper, old glass, hard substances, metals, plastics, succeeded by a comparative evaluation method, and the national economy aspect of the waste industry, with the savings effect in raw materials for different branches, effects on raw material reserves, the problem of dependence on imports, waste rates and living standard, and the importance of environmental instruments which are discussed in detail.

41009 **(PB—81-204448) Procurement of products containing recovered materials: a study of state of michigan practices. Final report.** Kittel, J. (Michigan Energy and Resource Research Association, Detroit (USA)). Mar 1981. 93p. NTIS, PC A05/MF A01.

The report examines the current State activities, regulations, statutes, and policies, as well as technical institutional and economic barriers relating to the public procurement of products containing recovered or recycled materials. The report also lists the top ten commodities procured by the State in dollars plus a listing of products that, in the opinion of the State, have a high potential for the use of recycled or recovered material. The report includes a list of recommendations or suggested actions that could be taken to potentially improve the manufacture, distribution, and procurement of products containing recovered or recycled materials.

41010 **(PB—81-204729) Hue factor - a measure of heat utilisation efficiency of a mill. Research note.** Parajia, J.S.; Prabhu, M.R.; Subrahmanyam, K. (SEE CODE- 9700602 Ahmedabad Textile Industry's Research Association (India)). Mar 1976. 19p. NTIS, PC A02/MF A01.

Efficient utilization of heat is a matter of great importance since fuel is becoming progressively more scarce and expensive. In order to assess the heat utilization efficiency of a mill as a whole, certain standards are to be had for steam and fuel consumption. These standards are the norms which on one hand signify an ideal efficiency but on the other, they are also totally practical and achieved under normal working conditions in mills. The first part of this paper therefore, deals with the norms and the second part, the method of computation of HUE factor where HUE stands for Heat Utilization Efficiency. Having defined the HUE factor and described the norms for various processing machines in the first part, Part II deals with the application of these concepts to evaluate

the HUE factor of a mill. Various unavoidable fuel losses in a mill are enumerated; the fuel consumption norm is defined and details of how to calculate the HUE factor are explained. Possible uses of the HUE factor approach are also given and methods of improving HUE factor briefly covered at the end.

41011 **(PB—81-205445) State of Florida: the procurement of products containing recovered materials. Final report.** (National Bureau of Standards, Washington, DC (USA)). Mar 1981. 195p. NTIS, PC A09/MF A01.

Portions of document are illegible.

The report examines the current State activities, regulations, statutes, and policies, as well as technical institutional and economic barriers relating to the public procurement of products containing recovered or recycled materials. The report also lists the top ten commodities procured by the State in dollars plus a listing of products that, in the opinion of the State, have a high potential for the use of recycled or recovered material. The report includes a list of recommendations or suggested actions that could be taken to potentially improve the manufacture, distribution, and procurement of products containing recovered or recycled materials.

41012 **(PB—81-206187) Development of mineral wool from industrial wastes. Phase i. Final report 1 Sep 80-28 Feb 81.** Ali, M.A. (Glass and Ceramics International, Inc., Lomita, CA (USA)). Feb 1981. 48p. NTIS, PC A03/MF A01.

The feasibility of using unprocessed industrial wastes to produce mineral wool was investigated by literature and patent searches and by experimental production of mineral wool. Slag ash from coal burning utilities and cement kiln waste from cement companies were combined in batch formulations having acid to alkali ratios of 0.8 to 1.2, then melted, fiberized, and analyzed for physical, thermal, chemical, and optical properties. Cement kiln waste added to the slag ash in controlled quantities served as a fluxing agent, and lowered the melting point of the slag ash from 2800 degrees F to 2500 degrees F. The softening point of the fibers was between 1250 degrees F and 1480 degrees F. The surface of the fibers was smooth at a magnification of 800x, and X-ray analysis showed no crystallization. The glasses were chemically stable, and possessed the rheological properties necessary to produce mineral wool. Potential applications include using the mineral wool for insulation. Immersion in cement slurry for 24 hours did not affect the fibers, indicating that they might also be used as alkali resistant components for fiber-reinforced concrete.

41013 **(PB—81-234221) Energy use patterns and environmental implications of direct-fired industrial processes. Final report 16 June-19 December 1979.** Hoover, J.R.; Blacksmith, J.R.; Spaite, P.W. (Radian Corp., Austin, TX (USA)). Aug 1980. 93p. (RAD—80-230-139-20-03). NTIS, PC A05/MF A01.

Energy consumption patterns and environmental impacts of direct-fired processes in the industrial sector were identified. The potential effects of fuel switching in several of these processes were determined. An extensive bibliography lists the sources consulted in this study.

41014 **(PB—81-242273) Waste plastic recycling information exchange. Volume I. Summary report.** (Monsanto Research Corp., Dayton, OH (USA); North Atlantic Treaty Organization, Brussels (Belgium). Committee on the Challenges of Modern Society; Environmental Protection Agency, Washington, DC (USA). Office of Research and Development). 1981. 66p. NTIS, PC A04/MF A01.

The study determined the status of plastic scrap and waste recycling in the participating NATO countries, with an analysis to provide general conclusions and make specific recommendations.

41015 **(PB—81-248163) Engineering handbook for hazardous waste incineration. Final report March-September 1981.** Bonner, T.A.; Cornett, C.L.; Desai, B.O.; Fullenkamp, J.M.; Hughes, T.W. (Monsanto Research Corp., Dayton, OH (USA)). Sep 1981. 487p. (MRC-DA—1090). NTIS, PC A21/MF A01.

The Resource Conservation and Recovery Act (RCRA) authorizes the United States Environmental Protection Agency (EPA) to regulate owners/operators of facilities that treat hazardous waste in incinerators. Pursuant to the legislative mandates specified in RCRA, the EPA has proposed regulations to ensure that hazardous waste incinerators are operated in an environmentally responsible manner. Specifically, the proposed regulations include an operational performance standard, general design and construction requirements, combustion and destruction criteria, waste analysis, trial burns, monitoring and inspections, recordkeeping and reporting, emission control criteria, control of fugitive emissions, and closure. The proposed regulations rely upon the technical advisory information contained in this document - Engineering Handbook for Hazardous Waste Incineration. The proposed regulations provide very little specificity pertaining to actual hazardous waste incineration performance requirements. Permitting official will set a 'standard' for each hazardous waste incineration facility based on the application of the criteria or factors contained in the proposed regulations and this document.

41016 **(PB—81-866279) Economics of the food industry: Energy aspects. January, 1977-May, 1981 (citations from the Energy Data Base). Report for January 1977-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 92p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning methods and processes for energy management and conservation by the food industry. Waste heat recovery systems, waste product utilization, solar collectors, co-generation of heat and electrical power, and more efficient energy utilization methods are considered. The design, operation and economics of some selected industrial plants are considered. (Contains 73 citations fully indexed and including a title list.)

41017 **(PB—81-866840) Energy conservation in the food industry. January, 1974-May, 1981 (citations from the Food Science and Technology Abstracts Data Base). Report for January 1974-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 87p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning energy conservation in the food industry. Energy requirements, basic approaches to energy audits, plant design and the equipment, fuel, and processing steps are discussed. Alternate energy sources, energy recovery, and other energy saving devices are considered as measures for conservation. Energy saving in dairies, meat packing plants, breweries and other processing plants are discussed. (Contains 105 citations fully indexed and including a title list.)

41018 **(PB—82-107541) Electric rates and boiler fuel choice. Final report May 80-Apr 81.** Sherrill, K.T.; Weatherby, J.L. Jr. (Radian Corp., Austin, TX (USA)). Sep 1981. Contract EPA-68-02-3171. 51p. NTIS, PC A04/MF A01.

This study was undertaken in response to an EPA/IERL-RTP request to examine in a 'quick look' fashion the economic tradeoffs of using purchased utility electricity as an alternative to on-site combustion of fossil fuels for industrial steam generation. Specifically, the impacts of marginal or incremental cost pricing of electricity and increasingly stringent industrial boiler emission controls were examined for a 44 MWt (150,000,000 Btu/hr heat input) industrial boiler. Data were compared to determine if electricity, despite its lower overall thermal efficiency, could be economically competitive with direct firing of fossil fuels in this size boiler.

41019 **(PB—82-110503) Open-cycle vapor compression heat pump. Annual progress report for 1980.** Sakhuja, R.; Becker, F.E. (Thermo Electron Corp., Waltham, MA (USA)). 5 May 1981. Contract GRI-5011-342-0094. 54p. NTIS, PC A04/MF A01.

Approximately 10 percent of U.S. energy is used by industry in the form of process steam at 100 psi or less. In many industrial plants, a portion of this steam is simply vented to the atmosphere or condensed after use in the process because it cannot be fully utilized or economically recovered. Also, a great amount of low-grade heat energy is wasted because it cannot be economically recovered. Recovery and upgrading of these low-grade steam or waste heat sources offers a great potential of energy conservation. Thermo

Electron is developing an open cycle vapor compression steam heat pump to meet this objective. The system utilizes excess low-pressure steam or that produced from an industrial excess heat source with a waste heat boiler and compresses this steam to the desired pressure level for process use. The compressor is driven by a prime mover such as a gas turbine, gas engine, etc. The prime mover exhaust heat also can be recovered to generate additional process steam. The fuel consumption of this system can be as low as 30 to 50 percent in comparison to a direct-fired boiler over the expected range of process conditions. Simple payback periods as low as one year can be achieved.

41020 **(TE—4214-75-77-Vol.2) Assessment of technologies for research, development, and demonstration of industrial cogeneration and waste heat recovery in the near term. Final report.** Fam, S.S.; Nydick, S.E. (Thermo Electron Corp., Waltham, MA (USA)). Jul 1977. Contract AC02-76CH02866. 30p. NTIS, PC A03/MF A01. Order Number DE82009117.

Programs recommended for government-sponsored research, development, and demonstration are described. The technologies were deemed valuable for potential fuel savings, economic viability, and potential near- to intermediate-term implementation. Combined generation of process steam and electricity programs include heat pumps, diesel topping, combined cycles, steam turbine cogeneration, and gas turbines. Waste heat recovery systems include combustion air preheating, steam generation, bottoming cycles for electrical generation from waste heat, power recovery from pressurized product streams, and product stream heat recovery. (MCW)

41021 **(TE—4214-75-77-Vol.2) Assessment of technologies for research, development, and demonstration of industrial cogeneration and waste heat recovery in the near term. Final report.** Fam, S.S.; Nydick, S.E. (Thermo Electron Corp., Waltham, MA (USA)). Jul 1977. Contract AC02-76CH02866. 30p. NTIS, PC A03/MF A01. Order Number DE82008504.

The status of advanced power systems that have the potential, when developed, of contributing to the generation of electricity in combination with process steam in the time frame from the present to 1985 to 1990, with particular applications in the chemical, petroleum refining, and paper and pulp industries was studied. Technical and economic analyses have been made of alternatives for the recovery of waste heat in the three industries and the potential for fuel savings for each of the alternatives was estimated. This report presents a number of research, development, and demonstration programs for the technologies that were deemed to warrant DOE support from the standpoint of energy conservation, economic viability, and potential for near- to intermediate-term implementation. The combined generation of process steam and electricity technologies is: heat pumps, diesel topping, combined cycles, steam turbine cogeneration, and gas turbines. The waste heat recovery systems are combustion air preheating, steam generation, bottoming cycles for electrical generation from waste heat, power recovery from pressurized product streams, and product stream heat recovery. (MCW)

41022 **(TVA/PUB—82/7) Effect of impurities in wet-process phosphoric acids on DAP grades.** Achorn, F.P.; Dillard, E.F.; Frazier, A.W.; Salladay, D.G. (Tennessee Valley Authority, Muscle Shoals, AL (USA)). Nov 1980. 29p. (CONF-8011147—1). NTIS, PC A03/MF A01. Order Number DE82901247.

From ISMA conference; Vienna, Australia (11 Nov 1980).

Results of this study identify the main problems in meeting diammonium phosphate (DAP) grade specifications and suggest some possible solutions to these problems as follows: 1. The major source of grade deficiency in the commercial samples which were investigated was calcium. Some solutions to this problem are to maintain filter cloths in the phosphoric acid unit in good condition, operate the phosphoric acid unit at as low an acid temperature as consistent with good operation of this unit, and partially clarify the acid before it is used. 2. In the DAP unit the amount of Fe_2O_3 and F in the acid affects the content of C.I. P_2O_5 in the product. If the F:Fe_2O_3 wt ratio in the product can be kept above 2.3:1, probably the C.I.-P_2O_5 content of the product will be less than 0.1 percent. At lower F:Fe_2O_3 wt ratios, it is advantageous to have low retention times in the preneutralizer and ammoniator-granulator when the N:P mole ratio is 1.4:1 or higher. 3. Other data show that the N:P mole ratio in the slurry from the preneutralizer to the granulator must be above 1.4:1 to avoid nitrogen deficiencies. At lower ratios the product will contain some MAP; this causes nitrogen deficiency in the products. 4. The Mg and Al contents of the acids have less effect on grade deficiency than Ca and Fe. 5. To avoid highly viscous preneutralizer slurries when low preneutralizer retention times are used, ensure that there is sufficient F available (F:Fe_2O_3 wt ratio $>$ 2.0:1) to combine with the Fe_2O_3 to form coarse crystals. An alternative to this latter suggestion is to replace the preneutralizer with a TVA pipe reactor which is partially installed in the granulator and discharges viscous slurry directly onto the bed of material in the granulator.

41023 **Recovery of arsenic from flue dust.** Madsen, B.W.; Dolezal, H.; Bloom, P.A.; Shirts, M.B. US Patent Application 6,254,317. 15 Apr 1981. 8p.

This invention relates to recovery of arsenic, and byproduct elements such as zinc, copper, cadmium and indium, from flue dusts, particularly flue dusts from smelter operations. It has now been found, in accordance with the invention, that a substantially more efficient and environmentally acceptable recovery of arsenic from flue dusts may be achieved by means of a hydrometallurgical process in which the flue dust is initially leached with sulfuric acid as elevated temperature to solubilize arsenic, followed by filtration and treatment of the filtrate with sulfur dioxide gas to reduce the solubilized arsenic to the trivalent state. The arsenic is then precipitated as As2O3 by cooling, or by addition of sulfuric acid followed by cooling.

41024 **Recovery of arsenic from flue dust.** Madsen, B.W.; Dolezal, H.; Bloom, P.A.; Shirts, M.B. US Patent Application 6,225,238. 15 Jan 1981. 8p.

This invention relates to recovery of arsenic, and byproduct elements such as zinc, copper, cadmium and indium, from flue dusts, particularly flue dusts from smelter operations. It has now been found, in accordance with the invention, that a substantially more efficient and environmentally acceptable recovery of arsenic from flue dusts may be achieved by means of a hydrometallurgical process in which an aqueous slurry of the flue dust is treated with sulfur dioxide gas to solubilize the arsenic, with subsequent precipitation of the arsenic as As2O3 by means of sulfuric acid.

41025 **Potential energy sources for the mining industry in Australia.** West, J.P. (South Australian Dept. of Mines and Energy); Tapp, B.A. (Royal Melbourne Inst. of Tech. (Australia)). pp 161-174 of Sydney conference, 1981. Parkville, Australia; Aus.I.M.M. (1981).

From Australasian Institute of Mining and Metallurgy conference; Syndey, Australia (1 Jul 1981).

The mining and mineral processing industries use 32% of the annual primary energy consumption in Australia. This share will increase with the realisation of the 1980's production expansion to 40% by 1985. Australia's ability to supply these energy needs and the options that might be considered in planning for future growth and utilisation of energy resources are discussed. There are distinct problems in utilising nuclear power for direct or sole use in the mineral industry.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 40363, 40394, 40960, 41008, 41009, 41011, 41014

41026 **(AD-A—102597/2) Energy conservation measures at Corps of Engineers recreation areas. Final report.** Palermo, M.R. (Army Facilities Engineering Support Agency, Fort Belvoir, VA (USA). Technology Support Div.). Apr 1981. 24p. NTIS, PC A02/MF A01.

This report identifies energy conservation measures at recreation areas now being used or contemplated by the Corps of Engineers. Consumption at these sites includes energy for lighting, hot

water heating, space heating, electrical hookup for campers and operation of water supply and waste water treatment facilities.

41027 (AD-A—103741/5) **Losses from the Fort Wainwright heat distribution system. Special report.** Phetteplace, G.E.; Willey, W.; Novick, M.A. (Cold Regions Research and Engineering Lab., Hanover, NH (USA)). Jun 1981. 33p. NTIS, PC A03/MF A01.

This report estimates the heat losses from the heat distribution system at Fort Wainwright, Alaska. Specific data on the Fort Wainwright heat and power plant are given and a method is then developed to calculate the heat losses from buried utilidor systems, such as the one at Fort Wainwright. This method is programmed for computer execution and estimates are made for the Fort Wainwright system, where heat losses are found to be 204,500 MBtu/y. Possible improvements to the system to reduce heat losses are examined. Of the possible combinations of additional pipe insulation investigated, the addition of 1 in. of insulation to the steam pipe only is the most economically favorable. The results also indicate that insulating only the generally larger pipes found in larger utilidors would be the most economically favorable approach. Possible reductions in heat losses due to reduced steam temperature are also given, as well as recommendations for refinement of the predictions.

41028 (ANL/CNSV-TM—95, pp 5-18) **Opportunities for energy conservation and production at New York State wastewater treatment plants.** Bogardus, E.R. (New York State Energy Office, Albany). Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

A brief history of the New York State Energy Office and its program to examine energy conservation opportunities in existing waste water treatment facilities are discussed. Eleven plants were selected for in-depth studies on ways to use presently wasted digester gas. The results of preliminary findings at the Town of Lewiston Waste Water Plant are summarized. Information is presented on plant background, sludge handling, sludge digesters, plant energy consumption, and increasing production and utilization of digester gas. Other programs briefly described involve energy conservation measures at water treatment plants in New York City and Syracuse, wind monitoring at five water treatment plants, and research on the microbial process in the digestion process. (MCW)

41029 (ANL/CNSV-TM—95, pp 19-25) **Rational design and control of compositing facilities.** Finstein, M.S.; Miller, F.S.; MacGregor, S.T.; Psarianos, K.M. (Rutgers Univ., New Brunswick, NJ). Feb 1982. NTIS, PC A12/MF A01.

In Energy conservation: retrofit of municipal wastewater treatment facilities.

The concepts of the roles of heat ant temperature, ventilation, and water removal when organic material is assembled into a self-insulating mass are summarized. The practical application of these concepts in static pile configuration or the Rutgers process outlined. The concepts and means of application are relevant to all design approaches whether or not a reactor structure is involved, whether the process is batch or continuous, and whether the mass is agitated or static. (MCW)

41030 (ANL/CNSV-TM—95, pp 27-43) **Quick payback on investment with belt filter presses.** McDonald, G.C.; Quinn, T.; Ponte, M. (Metcalf and Eddy of New York, Inc., NY). Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

Installation of belt filter presses to replae the vacuum filters at the Frank E. Van Lare Water Pollution Control Plant (Monroe County, New York) is described. Belt filters provide the needed additional incineration capacity and reduce fuel oil costs. The payback period was estimated to be one year. Specifications of belt filter press design criteria are tabulated. Operating cost and cost savings resulting from the installation of the new filters are also tabulated. (MCW)

41031 (ANL/CNSV-TM—95, pp 45-58) **Retrofitting municipal wastewater treatment plants - case histories.** Harrison, J.R. Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

A review of the ongoing expansion and retrofit programs at four publicly-owned-treatment works (POTW) during the 1960-81 period is presented. Rigorous pilot plant and full-scale process development studies to reduce energy consumption, lower operating and maintenance costs, and cope with more stringent effluent standards were conducted. Programs and results at the Blue Plains Plant, the Colorado Springs Plant, the Denver Metro Plant, and the Kalamazoo, Michigan Plant are described. (MCW)

41032 (ANL/CNSV-TM—95, pp 63-79) **Case histories of energy optimization for sludge incineration.** Niessen, W.R. (Camp Dresser and McKee Inc., Boston, MA). Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

Major energy uses in sludge incineration are reviewed. These include electricity (for furnace drives, scrubber and combustion air fans, and scrubber water pumps) and fuel (to evaporate moisture associated with sludge solids, heat furnace gases to levels where combustion takes place, control temperature profiles in the furnace, and compensate for heat losses). The use of recovered steam from sludge incineration is indicated. These general principles are illustrated in two case studies. The studies of the plants in Derry Townships (Hershey), Pennsylvania, and Linden, New Jsersey, concern mixed primary and waste activated sludge incineration. (MCW)

41033 (ANL/CNSV-TM—95, pp 81-92) **Co-disposal at the Middlesex County Utilities Authority.** Jacobs, A. (Metcalf and Eddy, Inc., Somerville, NJ). Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

The benefits of the Middlesex County Utilities Authority's plan for co-disposal of municipal refuse and sludge are described. Co-disposal would involve co-firing of sludge along with refuse in a waterwall boiler. Heat recovered from the process would be used to generate steam and electric power to operate the Authority's Central Water Pollution Control Plant. The economics of the system is reviewed. Actions necessary to proceed with the project are stated. The plan failed to pass. (MCW).

41034 (ANL/CNSV-TM—95, pp 93-105) **Hyperion energy recovery system (HERS): an innovative approach to sludge management.** Haug, R.T.; Sizemore, H.M. Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

A description of the long-range sludge management plant developed for the City of Los Angeles, a plan named the Hyperion Energy Recovery System (HERS), is presented. Energy recovery elements of the system, the rationale for its selection, projected mass and energy balances, and air quality impacts are discussed. (MCW)

41035 (ANL/CNSV-TM—95, pp 107-113) **Heat recovery from sludge incineration - fact or fiction.** Bergstedt, D.C. Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

The state-of-the-art of recovering useful heat from waste water sludge is surveyed. The five practical sludge incineration furnace configurations considered are multiple hearth, fluidized bed, flash dryer associated with a single combustion chamber, rotary

combustor, and moving belt infrared incinerators. Brief survey data are reported on 32 sites. (MCW)

41036 (ANL/CNSV-TM—95, pp 117-132) **Digestion gas utilization in a cogeneration system.** Balan, M.H.; Jung, D.L. (Brown and Caldwell, Pasadena, CA). Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

Waste water treatment plants designed to optimally use digester gas are described. Major aspects of these designs are discussed. The gas management system provides the quantity as well as the quality of digester gas to be used in the engine generators. The heat recovery system extracts heat from the engine generators through various heat sources and utilizes the heat energy throughout the plant in both process and nonprocess operations. The cogeneration system includes parallel generation of electric power with the utility company, and includes the sell-back of excess power to the utility grid. Also included in the designs are four unique modes of application of the generators to provide a cogeneration system, a peak shaving system, an isolated system, or an emergency energy system. The available energy from digester gas is indicated. (MCW)

41037 (ANL/CNSV-TM—95, pp 133-161) **Anaerobic filter treatment of thermal conditioning wastes to save energy.** Dague, R.R. (Univ. of Iowa, Iowa City). Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

Thermal conditioning improves the dewaterability of activated sludges, enables a more favorable heat balance upon incineration, and reduces the need for supplementary fuels. The true impact of the return of high-strength recycle streams from thermal conditioning in terms of increased sludge production and oxygen consumption in the activated sludge process is examined. The effectiveness of the anaerobic filter treatment of the recycle flow from thermal sludge conditioning and dewatering is determined. The research procedure and results are given.

41038 (ANL/CNSV-TM—95, pp 199-214) **Energy economy by process and control system modification.** Cochrane, J.J. (Northeastern Univ., Boston, MA); Marc-Aurele, F.J. Jr. Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

Aeration devices and sludge treatment and disposal are identified as energy intensive areas in municipal waste water treatment plants. The data presented focus on the following: to identify and quantify the economic savings to be realized by employing more radical techniques; to upgrade existing energy intensive equipment; and to broaden the perspective and not be limited to the particular options existing at any one waste water treatment plant. To achieve these ends the means which were employed involved the CAPDET Computer Model Program for various sizes and systems of waste water treatment plants. Retrofitting concepts which involve physical and operational arrangements are considered and evaluated from performance and economic points of view. (MCW)

41039 (ANL/CNSV-TM—95, pp 215-229) **Gas turbines for waste control treatment plants.** Williams, T.D. (Alpha United, Inc., El Segundo, CA). Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

Many waste systems are known for treating waste water treatment sludge in order to minimize the costs of final disposal and recover energy for use in the plant. New electric power conversion systems that show promise for operation with sludge disposal systems are: anaerobic digestion using the digestion gas as fuel for a gas turbine and the treating and incineration of sludge with recovery by means of an indirectly fired gas turbine with electrical generators. The first option is a low pressure ratio gas turbine with an integrated gas compressor. The second option is a low pressure ratio gas turbine combined with a waste heat boiler for operating in an open combined cycle mode. The third option is a low pressure ratio gas turbine integrated with a high temperature heat exchanger and operated in a downheated cycle mode. Each of these technologies could be configured to meet the needs of a waste water treatment facility depending upon the type of system employed by the facility to transform the sludge into gas. These power conversion systems that are currently being developed are discussed.

41040 (ANL/CNSV-TM—95, pp 231-245) **Ancient pump sets modern standards: an energy-efficient solution to low-lift, variable speed pumping applications.** Malm, A.P. (Lakeside Equipment Corp., Bartlett, IL). Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

Use of Archimedean screw pumps in waste water treatment plants is discussed. The pump is used in raw sewage lift stations, storm water holding basins, return sludge lift stations, and effluent lift stations. Screw pumps maintain energy efficiency advantages over nonclog centrifugal pumps in low-lift, variable speed, solids-laden pumping applications. Pump, drive, and lift station designs are described briefly. Pump serviceability and limitations are discussed.

41041 (ANL/CNSV-TM—95, pp 247-264) **Saving energy with variable speed drives.** Hamilton, R.N. (Robicon Corp., Pittsburgh, PA). Feb 1982. NTIS, PC A12/MF A01. Contract W-31-109-ENG-38.

From Conference on energy conservation: retrofit of municipal wastewater treatment facilities; Los Angeles, CA, USA (23 Jun 1981).

Variable speed drives functioning in place of valves for control of flow for energy savings in municipal waste water treatment plants are explored. The potential energy savings are indicated. The theory of how several available variable frequency drives work and why they have great potential in retrofit application is reviewed. The requirements for varying the speed of an AC motor is examined and how this can be done with a current source variable frequency control using a silicon controller rectifier is illustrated.

41042 **(DOE/CS/20239—1) Development of a waste-to-energy plan: city of Columbia, Missouri.** (Columbia, City of, MO (USA)). Feb 1982. Contract FG01-79CS20239. 93p. NTIS, PC A05/MF A01. Order Number DE82009288.

The objective of the investigation is the development of a practical plan whereby energy can be recovered from the solid wastes generated in the Columbia, Missouri area. This plan proceeds only to the point at which the City of Columbia and the University of Missouri can determine their most appropriate course of action. The approaches explored in the development of the plan include: use of shredded solid waste in the existing stoker-fired boilers and use of unprocessed solid waste as fuel in modular burning units equipped with waste heat boilers for the production of steam. This approach would be applicable to the University of Missouri system, which has the potential capability of utilizing all of the steam which could be produced from the available waste and also would potentially be applicable for local industrial uses. The other approach is the use of the gases of combustion from the primary chambers of modular burning units for direct injection into the furnace of an existing gas-fired municipal boiler. This approach has been extended to include coal-fired boilers as well. Included in the investigation is a general assessment of the type and quantities of hazardous wastes generated in the community. The specific needs of the University of Missouri (UMC) regarding incineration of hazardous waste were specifically investigated because this method would have a decided impact on all of the potential waste to energy plans for the community. (MCW)

41043 **(HRP—0902643/6) Incorporating energy planning into health systems planning. Technical Assistance Memo-68.** Brinckerhoff, P. (Western Center for Health Planning, San Francisco, CA (USA)). Oct 1980. 10p. NTIS, PC A02/MF A01.

Although energy contingency planning is not presently a Federal priority, Health Systems Agencies (HSAs) should anticipate and plan for the potentially devastating effects of energy shortages. Considerations include travel to and from health services and facilities when gasoline costs are high and gasoline is rationed; growing independence from traditional primary and acute care and awareness of preventive medicine; potential effects on the mental health of Americans, and maintenance of home services. Planners should advise that new facilities be located within convenient distance to other community services. Planners should consult other government and health-related entities interested in energy conservation or which may be seriously affected by a shortage. Energy-related goals and objectives should be included in the health systems plan (HSP) and every community should have an energy contingency plan. The HSA can put energy efficiency criteria and standards in the HSP for each type of service, can help hospitals and nursing homes evaluate and improve energy efficiency, and can use the media and numerous consumer and provider groups to raise the public's awareness of the topic. If HSAs can become energy advocates, they may stand a better chance of continuing as viable, useful, and productive entities.

41044 **(NP—2750075) Order No. 522 of 2 Dec 1980 on establising earth heat systems (underground heat tubes).** 2 Dec 1980. 4p. (In Danish). Risoe Library, DK-4000 Roskilde, Denmark.

The order lays down the rules of authorization of the local councils and the National Agency of Environmental Protection for establishing earth heat systems (undergrond pipes). It also lays down the rules for the supervision of these systems. Also some technical requirements of the pipes are given.

41045 **(PB—81-202525) Solid waste disposal and resources recovery by composting process, part i. Technical report.** Cardenas, R.R. Jr; Wang, L.K. (Stevens Inst. of Tech., Hoboken, NJ (USA). Dept. of Mechanical Engineering). Jan 1981. 42p. NTIS, PC A03/MF A01.

The microbiology, classification, biochemical reactions and engineering design approach of biological composting process are presented and discussed. Topics include microorganisms, aerobic and anaerobic systems, mesophilic and thermophilic temperatures, windrow and mechanical compostings, bath and continuous operations, compostable materials, and conventional and unconventional methods. Major process/operation sequence in composting, such as pretreatment, digestion, curing, finishing, upgrading and storage, are summarized and assessed.

41046 **(PB—81-808008) Waste heat utilization. 1979-July 1981 (citations from the NTIS data base). Report for 1979-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 155p. NTIS PC N01/MF N01.

Federally-funded research on techniques of recovering waste heat from power plants, buildings, industrial processes, and waste disposal is covered. Studies of waste heat boilers and the use of waste heat for irrigation, sewage treatment, odor control, desalination, heating, and aquaculture are included. (This update bibliography contains 145 citations, 53 of which are new entries to the previous edition.)

41047 **(PB—81-808016) Waste heat utilization. 1979-July 1981 (citations from the Engineering Index Data Base). Report for 1979-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 251p. NTIS PC N01/MF N01.

Worldwide research of waste heat utilization from industrial process plants, electric power plants, buildings, and incineration of wastes is covered. Emphasis is on energy conservation in industrial plants. Studies of waste heat boilers and the use of waste heat for irrigation, sewage treatment, odor control, desalination, and heating are included. (This updated bibliography contains 243 citations, 97 of which are new entries to the previous edition.)

41048 **(PB—81-808982) Regional and urban waste disposal: management planning. 1964-August 1981 (citations from the NTIS data base). Report for 1964-August 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 282p. NTIS PC N01/MF N01.

Management, state, and local government policies, legislation, financing, data acquisition, and general planning studies for urban and regional solid waste disposal systems are covered. The topics include comments on public health, landfills, pollution, recycling, and load use. Studies on energy recovery and consumption, environmental impacts, land use, guidelines, and models are also covered. (This updated bibliography contains 277 citations, 6 of which are new entries to the previous edition.)

41049 **(PB—81-808990) Regional and urban solid waste disposal: local case studies. 1964-August 1981 (citations from the NTIS data base). Report for 1964-August 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 260p. NTIS PC N01/MF N01.

Case studies are cited on municipal waste disposal in specific cities, counties, or regions. These studies include aspects of collection, hauling, incineration, sanitary landfills, ocean dumping, and transfer stations as applied to a specific locale. Management studies designed only for these areas are also included. (This updated bibliography contains 255 citations, 14 of which are new entries to the previous edition.)

41050 **(PB—81-809006) Regional and urban solid waste disposal: handling and disposal technology. 1964-August 1981 (citations from the NTIS data base). Report for 1964-August 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 300p. NTIS PC N01/MF N01.

The citations cover the technology and techniques of collection, hauling, sorting, processing, disposal, incineration, and recycling of urban wastes. These abstracts were chosen to describe methods and equipment for waste handling, disposal, or reclamation. In addition, studies on refuse derived fuels and energy consumption in solid waste processing are covered. (This updated bibliography contains 295 citations, 29 of which are new entries to the previous edition.)

41051 **(PB—82-102302) Impediments to energy and materials recovery facilities for municipal solid waste. Final report.** Manuel, E.H. Jr; Efaw, F.W. (Mathtech, Inc., Princeton, NJ (USA)). Sep 1981. Contract EPA-68-03-2761. 229p. NTIS, PC A11/MF A01.

Public anticipation that recycling would eventually solve the solid waste disposal problem, and simultaneously conserve natural resources, has persisted since enactment of the Resource Recovery Act of 1970 (P.L. 91-512). Progress toward these goals has fallen considerably behind initial expectations, however. Various explanations for the slow progress have been suggested, and federal research has focused mainly on the technological difficulties associated with resource recovery. In 1978 the U.S. Environmental Protection Agency contracted with Mathtech, Inc., a subsidiary of Mathematica, to study the impediments to recycling municipal solid waste. The eight facilities selected for indepth analysis represented a cross-section of technologies, ownership types, geographical locations, and recovered products. None of the facilities were economical in the context of providing the least cost mode of disposal, and all eight facilities experienced net operating losses. A major impediment encountered by most of the facilities was competition from lower-cost landfills.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 41060, 41072, 41073, 41074, 41075, 41076, 41080, 41081, 41083, 41084

41052 (PB—81-132979) Evaluation of sealed idle mixture adjustment on 1977 Buicks. Report EPA-AA-TEB-81-8. Marschall, K.E. (Environmental Protection Agency, Ann Arbor, MI (USA)). Nov 1980. 22p. NTIS, PC A02/MF A01.

This report describes the results of an EPA program conducted on 48 in-use passenger cars. Each of these vehicles was a 1977 Buick equipped with a 350 CID engine and a four barrel carburetor. Some of these engines were equipped with special carburetors which had lead plugs covering their idle mixture screws to prevent maladjustments. The purpose of this program was to gather information on current vehicles which will allow EPA to project the effectiveness of similar systems after they have been employed on future vehicles. The program included direct mail solicitation, a parking lot survey, and complete FTP testing. This work was conducted in the Detroit area and at EPA's Laboratory in Ann Arbor during the summer of 1980. The results indicate that this technique for sealing the idle mixture screws is an effective method for preventing the adjustment of the idle mixture. Average idle emission test results for the sealed carburetor vehicles were similar to the results for untampered vehicles with conventional carburetors. Average idle emissions from vehicles with broken or missing limiter caps were substantially higher.

41053 (PB—81-133142) Exhaust emissions from a turbocharged Texaco Combustion Process (TCP) stratified charge engine. Report EPA-AA-TEB-80-5. Thomson, J.C. (Environmental Protection Agency, Ann Arbor, MI (USA)). Apr 1970. 9p. NTIS, PC A02/MF A01.

Texaco, Inc., through a US Army contract has built an updated version of their stratified charge engine. Because preliminary Texaco data showed a significant reduction in emissions from previous NAPCA results, an emission test program was conducted on the new engine. The engine was installed in the same M-151-1/4 ton Army Jeep used in the previous test. Tests were conducted on the chassis dynamometer using both continuous analysis and the constant volume sampling system. Two fuels, and a mixture of the fuels, were used and both hot and cold starts were monitored.

41054 (PB—81-133399) Emissions and fuel economy of a Comprex pressure wave supercharged diesel. Report EPA-AA-TEB-81-1. Barth, E.A.; Burgenson, R.N. (Environmental Protection Agency, Ann Arbor, MI (USA)). Oct 1980. 10p. NTIS, PC A02/MF A01.

In order to increase public interest in vehicles equipped with diesel engines, methods of improving diesel-fueled engine performance, as compared to current gasoline-fueled counterparts, are being investigated. One method to increase performance is to supercharge or turbocharge the engine. This report details an EPA assessment of a supercharging technique previously evaluated, however, since that evaluation, specific areas of operation have been refined.

41055 (PB—81-133548) Emissions from a pick-up truck retrofitted with a Nissan diesel engine. Report EPA-AA-TEB-74-1. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1973. 7p. NTIS, PC A02/MF A01.

Equipment Sales, Inc., of West Chicago, Illinois deals in the retrofitting of pick-up trucks with Chrysler-Nissan 6N633 swirl chamber diesel engines. This type of vehicle was of interest to the EPA's Emission Control Technology Division (ECTD) as it relates both to ECTD programs in the areas of exhaust emissions from medium duty vehicles and exhaust emissions from small diesel engines which may be applicable to passenger cars. ECTD contacted the President of SandS and asked if he was interested in having EPA test one of his vehicles. It was agreed and the vehicle tested was a 1973 Ford F-250 pick-up truck with 4-speed manual transmission, retrofitted with a Chrysler-Nissan 6N633 swirl chamber diesel engine. The engine has 6 cylinders with 198 CID. At the time of testing over 10,000 miles had been accumulated on the vehicle.

41056 (PB—81-136384) Exhaust emissions from a stratified charge Ford Combustion Process (FCP) engine. Report EPA-AA-TEB-70-3. Thomson, J.C. (Environmental Protection Agency, Ann Arbor, MI (USA)). May 1970. 11p. NTIS, PC A02/MF A01.

The Ford Motor Company, through joint US Army-NAPCA contracts, has produced a low emission version of their stratified charge engine. This engine is a modification of the Ford combustion engine tested by NAPCA. The engine, a modification of the L-141 military engine, was installed in a M-151-1/4 ton Army Jeep similar to the one used in previous tests. The engine was tested both with and without an exhaust catalyst. Unleaded Indolene was used when the exhaust catalyst was in place, and Indolene 30 was used in the other test.

41057 (PB—81-141533) Testing support for an evaluation of a Houston physical and functional inspection/maintenance program. Final report. (Automotive Testing Labs., Inc., Aurora, CO (USA)). Oct 1980. 314p. NTIS, PC A14/MF A01.

The standard mass emission (Federal Test Procedure) was performed for determination of the effects of inspection and maintenance on a sample of passenger cars operating in the Houston area. This sample was also used for obtaining abbreviated emission test (short cycle test), fuel economy, and emission component system maladjustment and disablement and other data. Four-hundred eighty vehicles were inspected under the program: one-hundred from the 1980 model year, one-hundred 1979 vehicles, one-hundred 1978 vehicles, sixty 1977 vehicles, sixty 1976 vehicles and sixty from the 1975 model year. Both domestic and imported auto makes were examined. All vehicles which failed an initial inspection, a total of 206 vehicles, were subject to a baseline and set of replicate test sequences comprised of the FTP, the 50 Cruise Test, the Highway Fuel Economy Test, the Loaded Two Mode Test and the Four Speed Idle Test. A prescribed maintenance step preceded each of the replicate sequences. Failed vehicles were further subject to an emission control system maladjustment/disablement and status inspection, driveability evaluations and owner-interviews to obtain vehicle maintenance and useage data.

41058 (PB—81-245722) Evaluation of a Dresserator system test vehicle. Technical report. Penninga, T.J. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1981. 38p. (EPA-AA-TEB—81-21). NTIS, PC A03/MF A01.

A test vehicle supplied by Dresser Industries was tested at the EPA Motor Vehicle Emission Laboratory to determine the feasibility of the Dresser Sonic Flow Carburetor system as applied to a 3-way catalyst system. The testing conducted included the standard Federal Testing Procedure, Highway Fuel Economy Testing, testing at 20, 40, 60, and 70 degrees F and sulfate testing. The test vehicle achieved emission levels below the 1981 and subsequent model year standards of .41 gm/mile hydrocarbon, 3.4 gm/mile carbon monoxide and 1.0 gm/mile NOx. The vehicle suffered starting problems at lower temperatures but had no driveability problems when warmed up. An extended idle period at the beginning of the cold start test procedure was also used at lower temperature. This modified FTP procedure improved driveability and lowered vehicle emissions somewhat.

41059 Success at last for this 40-year-old stratified-charge engine. Lindsley, E.F. *Popular Science;* **219**: No. 5, 82-83(Nov 1981).

A United Parcel Service (UPS) program for demonstrating the performance of the Texaco Controlled-Combustion System (TCCS) which was retrofitted to standard internal combustion engines in UPS vans is described. This TCCS modification is claimed to much less expensive than converting to diesel engines in the vans, can run on any liquid fuel, and increased fuel economy by 35% as compared with the standard GM internal combustion engine supplied with the van. (LCL)

3303 Electric-powered Systems

41060 (AD-A—103810/8) The electric vehicle alternative. Master's thesis. Swanson, D.E.; Van House, M.R. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Jun 1981. 145p. NTIS, PC A07/MF A01.

This thesis discusses three basic concepts of economic analysis: the time value of money, life cycle cost, and reliability theory. Using these concepts, a method of economic analysis is developed to be used in evaluating the possible replacement of internal combustion engine (ICE) vehicles with electric vehicles (EVs). This methodology is then demonstrated by comparing two possible alternatives for replacement of the existing fleet of pickup trucks assigned to the 4950th Test Wing Aircraft Maintenance Complex at Wright-Patterson AFB, Ohio. One alternative is to replace the existing pickup fleet with new ICE pickups, the other is to replace the existing fleet with EVs. In this research effort the ICE pickup fleet is found to be the low cost alternative. Recommendations for further research and additional considerations are provided to the reader. This thesis contains an extensive bibliography on EV technology and principles of economic analysis.

41061 (PB—82-109307) A survey of electric propulsion motors for automated guideway transit vehicles. del Cid, L. (Mitre Corp., McLean, VA (USA). METREK Div.). Jul 1981. Contract DTUM60-80-C-71020. 104p. NTIS, PC A06/MF A01.

Increasing interest in developing more efficient and lighter weight motors for transportation use stems from the advances made in power solid state devices, permanent magnet technology, and modern manufacturing processes. This report presents an overview of the current status of electric motors with potential applications in automated guideway transit (AGT) systems to be deployed in the 1990s. It is based on information and data gathered from electric machinery manufacturers, research organizations, and technical literature. This report surveys direct current (d.c.) motors, and reviews induction, synchronous, and linear electric motors. Performance characteristics of typical state-of-the-art d.c. and induction motors are provided. Current work on improved and advanced designs of rotary and linear motors are also reviewed. Some conclusions presented in this report state that: (1) performance requirements of existing AGT concepts can be satisfied with available technology traction motors; (2) conventional d.c. motors with switched power supplies will continue to be the most widely used motor for traction application; and (3) solid state devices will be a major factor towards achieving improved motor performance. This report provides numerous charts/figures that depict the technological aspects of d.c. motors, induction motors, synchronous motors, and linear electric motors. The report provides a glossary and a list of references.

41062 Investigation of the service and refueling infrastructure for energy storage vehicles. Wall, J.D. Fayetteville, AR; Univ. of Arkansas (1980). 120p. University Microfilms Order No. 80-26,082.

Thesis (Ph. D.).

The service infractructure for energy storage vehicles (ESV's) is examined to determine barriers to the introduction of ESV's into the private transportation sector. ESV's examined include electrically rechargeable battery powered vehicles, aluminum/air fuel cell vehicles, and hydrogen-powered vehicles. Implications of infrastructure for hybrid vehicles are also discussed. Service delivery systems and refueling methods are identified for the varioues ESV's. Refueling methods for electrically rechargeable vehicles, which are investigated, include overnight home recharging, recharging at parking facilities of businesses, employers and institutions (distributed refueling) and battery exchange systems. The potential for each method is examined and the relative cost of various alternatives is investigated. Production, distribution and supply of aluminum fuel for aluminum/air ESV's are investigated. Recycling of the fuel cell by-product (aluminum hydroxide) into aluminum fuel is examined. Production, distribution and delivery of hydrogen for ESV use are considered. Retrofitting possibilities of existing service facilities are examined for each ESV type. Design implications for retrofitting and new facility construction are discussed. A summary and conclusions are reported along with significant recent developments.

3306 Vehicle Design Factors

41063 (NASA-CR—165246) On variable hydrostatic transmission for road vehicles, powered by supply of fluid at constant pressure. Magi, M.; Freivald, A. (AB, Goteborg); Anderson, I. (Volvo Flygmotor A.B., Trollhaettan (Sweden)). May 1981. 122p. NTIS, PC A06/MF A01.

Various hydrostatic power transmission systems for automotive applications with power supply at constant pressure and unrestricted flow and with a Volvo Flygmotor variable displacement motor as the principal unit were investigated. Two most promising concepts were analyzed in detail and their main components optimized for minimum power loss at the EPA Urban Driving Cycle. The best fuel consumption is less than 10 lit. per 100 kM for a 1542 kG vehicle with a hydrostatic motor and a two speed gear box in series (braking power not recovered). Realistic system pressure affects the fuel consumption just slightly, but the package volume/weight drastically. Back pressure increases losses significantly. Special attention was paid to description of the behavior and modeling of the losses of variable displacement hydrostatic machines.

41064 Split-personality transmission: shifts like an automatic, saves fuel like a manual. Scott, D. *Popular Science;* **219**: No. 5, 92(Nov 1981).

The design, operation and performance of a British-invented automatic transmission which claims to result in fuel economy valves equal to those attained with manual shifts are described. Developed for both 4-speed and 6-speed transmissions, this transmission uses standard parts made for existing manual transmissions, rearranges the gear pairings, and relies on a microcomputer to pick the optimal shift points according to load requirements. (LCL)

3307 Emission Control

REFER ALSO TO CITATION(S) 41052, 41053, 41054, 41055, 41056, 41057, 41058

41065 (PB—81-133001) Evaluation of Aquablast's Wyman valves. Report EPA-AA-TEB-74-3. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1973. 6p. NTIS, PC A02/MF A01.

Representatives from Aquablast Inc. of Scarborough, Ontario, Canada, contacted the Emission Control Technology Division inquiring about the possible testing by EPA of vehicles with their Wyman valves installed. Data was supplied showing significant reductions of carbon monoxide on vehicles with the valves installed. ECTD agreed to test their product on two vehicles.

41066 (PB—81-133589) Evaluation of the Gould Incorporated NO/sub x/ catalyst. Report EPA-AA-TEB-74-2. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1973. 5p. NTIS, PC A02/MF A01.

Gould Incorporated has has a long-term development program in the area of NO/sub x/ catalysts. Because their catalyst has demonstrated potential for good NO/sub x/ control, a test program on a low mileage vehicle was undertaken by the Test and Evaluation Branch.

41067 (PB—81-134710) Operation of a pilot motor vehicle inspection station in Houston, Texas. Final report. Arrigo, A.J. (Hamilton Test Systems, Inc., Phoenix, AZ (USA)). Nov 1980. 225p. NTIS, PC A10/MF A01.

In conjunction with an EPA project to assess methods, costs, projected effectiveness and acceptability of various motor vehicle exhaust emissions inspection and maintenance (I/M) alternatives, and to support the State of Texas in complying with its implementation plan, the Office of Mobile Source Air Pollution Control of the US Environmental Protection Agency assisted the Texas Air Control Board in establishing a pilot motor vehicle emissions inspection and maintenance program in Houston, Texas. A portion of the program involved the operation of a centralized vehicle

emissions inspection station which performed idle tests, underhood inspections of emission control systems and components, and physical/functional I/M tests to simulate the operation of the various alternative configurations for the legislatively mandated I/M program.

41068 **(PB—81-136061) Exhaust emissions from a passenger car equipped with a DuPont exhaust emission control system. Report EPA-AA-TEB-70-4.** Thomson, J.C. (Environmental Protection Agency, Ann Arbor, MI (USA)). May 1970. 7p. NTIS, PC A02/MF A01.

The exhaust emission characteristics of a vehicle equipped with a DuPont exhaust emission control system were measured to provide a comparison with other low emission vehicles having the potential for meeting proposed 1975 Federal Standards. To obtain emission data, DuPont delivered for test a 1970 Chevrolet equipped with their latest reactor system. This was a typical vehicle with the following modifications: exhaust manifold reactor, exhaust gas recirculation, manifold air injection, particulate traps with special exhaust systems, and carburetor modifications. The vehicle used a 350 cubic inch engine with automatic transmission. All tests were run using Indolene 30 fuel.

41069 **(PB—81-136327) Overview of several EPA misfueling test programs. Report EPA-AA-TAB-81-4.** Tupaj, T.A. (Environmental Protection Agency, Ann Arbor, MI (USA)). Oct 1980. 43p. NTIS, PC A03/MF A01.

A group of test programs were performed on current passenger cars to assess the rate of catalyst deterioration due to misfueling with leaded gasoline. These programs addressed both casual misfueling as well as intentional misfueling. Recovery of the catalyst upon return to unleaded fuel was also assessed. On the average, one tankful of leaded gasoline was found to triple hydrocarbon (HC) emissions while causing emissions of carbon monoxide (CO) to double. Continued use of leaded gasoline in vehicles designed to meet 1980 Federal Emission Standards resulted in HC and CO emissions increasing to levels which exceeded 1975 Federal Standards. Return to unleaded fuel resulted in recovery of some catalytic activity on slightly poisoned vehicles although continued use of leaded fuel resulted in a permanent loss of catalytic activity.

41070 **(PB—81-136376) Emissions from standard M-151 jeep. Report EPA-AA-TEB-70-1.** Caggiano, M.A. (Environmental Protection Agency, Ann Arbor, MI (USA)). Feb 1970. 8p. NTIS, PC A02/MF A01.

A series of tests has been completed on a standard Army M-151 Jeep. The testing consisted of hot and cold starts as received, hot starts with a vacuum advance distributor and hot start with leaned idle A/F. Emissions were measured simultaneously by the 1970 Federal procedure and the Constant Volume Sampling (CVS) procedure. In addition, oxides of nitrogen (NOx) were measured in the CVS sample bag by the Saltzman technique.

41071 **(PB—81-136392) Effect on exhaust emissions of the CETEC (Consolidated Engineering Technology Corp.) atom-x device. Report EPA-AA-TEB-70-5.** Caggiano, M.A. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1970. 9p. NTIS, PC A02/MF A01.

In September of 1968, an unsolicited proposal from Consolidated Engineering Technology Corp. (CETEC), a subsidiary of Technology Incorporated, was evaluated. The proposal was for a research effort to determine the mechanism by which a device affected the fuel such that combustion chamber deposits were changed and emissions reduced. The device, which is installed in the fuel line between the fuel pump and carburetor, subjects the fuel to a low intensity magnetic field (from a series of permanent magnets) and a 12 volt electrostatic potential. A decision was made to initiate a test program to evaluate the effect of the device on exhaust emissions. This report summarizes the program and its results.

41072 **(PB—81-165920) Application for certification 1981 model year light-duty vehicles - American Motors Corporation.** (American Motors Corp., Detroit, MI). 1981. 1565p. NTIS PC $83.25/MF$8.25.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

41073 **(PB—81-165953) Application for certification 1981 model year light-duty vehicles - Chrysler Corporation.** (Chrysler Corp., Detroit, MI (USA)). 1981. 4573p. NTIS PC $233.75/MF$16.00.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

41074 **(PB—81-165961) Application for certification 1981 model year light-duty vehicles - Fort Motor Company.** (Ford Motor Co., Dearborn, MI (USA)). 1981. 3669p. NTIS PC $188.50/MF$14.00.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

41075 **(PB—81-166407) Application for certification 1981 model year heavy-duty gasoline vehicles - Chrysler Corporation.** (Chrysler Corp., Detroit, MI (USA)). 1981. 530p. NTIS PC $31.50/MF$5.50.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

41076 **(PB—81-166415) Application for certification 1981 model year heavy-duty gasoline vehicles - Ford Motor Company.** (Ford Motor Co., Dearborn, MI (USA)). 1981. 530p. NTIS PC $31.50/MF$5.50.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems, and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Sumary Sheet Input Form on which issuance of a Certificate of Conformity is based.

41077 **(PB—81-200289) Application for certification 1981 model year light-duty vehicles - Volkswagen.** (Volkswagen of America, Inc., Ann Arbor, MI). 1981. 1824p. NTIS, PC A96.25/MF$9.00.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

41078 **(PB—81-200297) Application for certification 1981 model year motorcycle - Honda.** (American Honda Motor Co., Inc., Gardena, CA). 1981. 1300p. NTIS, PC A70.00/MF$7.25.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing. Section 16 of the application contains the results of emission testing, a statement of compliance to the regulations, production engine parameters, and a Summary Sheet Input Form on which issuance of a Certificate of Conformity is based.

41079 **(PB—81-240327) Preliminary investigation of light-duty diesel catalysts. Final report.** Bykowski, B.B. (Southwest Research Inst., San Antonio, TX (USA); Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div.). Jan 1980. 56p. NTIS, PC A04/MF A01.

The laboratory testing of prototype Diesel catalytic converters on a production light-duty Diesel vehicle is described. Two manufacturers submitted catalysts which were retrofitted on the vehicle's exhaust system individually. Regulated and several unregulated emission rates were determined during the Federal Test Procedure (FTP) and the Highway Fuel Economy Test (HFET) for each system. Particulate rates and particulate collection for Ames bioassay was also determined. In addition to fresh Diesel catalysts, an aged Diesel catalyst was also evaluated. The emission rates of hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NOx), individual hydrocarbons, aldehydes, sulfates, and particulates are reported in grams per kilometer.

41080 **(PB—81-244048) Characterization of diesel emissions as a function of fuel variables. Final report September 1979-March 1981.** Bykowski, B.B. (Southwest Research Inst., San Antonio, TX (USA)). Apr 1981. 288p. NTIS, PC A13/MF A01.

Several properties of a refinery 'straight-run kerosene', which had a narrow boiling range approximating the middle of a No. 1 diesel fuel, were altered to study their effects on regulated and unregulated exhaust emissions. Eleven fuel blends, representing changes in nitrogen content, aromatic level, boiling point distribution, olefin content, and cetane number, were evaluated in a 1975 Mercedes-Benz 240D. Statistical analysis, including regression, was performed using selected fuel properties as independent variables. Higher aromatic levels were generally associated with increased emissions, while increased olefin levels were generally associated with decreased emissions.

41081 **(PB—82-104225) Acoustic and emission characteristics of small, high-speed internal combustion engines. Final report Jun 76-Sep 79.** Morrison, D.; Karsick, R.V. (Calspan Advanced Technology Center, Buffalo, NY (USA)). Jul 1981. Contract DOT-TSC-1242. 362p. NTIS, PC A16/MF A01.

The intent of this study is to obtain information on small high-speed engines so that their effect on the urban environment may be assessed, and if necessary, programs devised to reduce the noise and other emissions from vehicles using these highly desirable and efficient power plants.

41082 **Study on the supported oxide catalysts for reducing Co gas in automotive exhaust gas.** Kim, H. *Yo-up Hoeji;* 17: No. 4, 179-187(1980). (In Korean).

Perovskite-type oxide catalysts in the $LaMnO_3$ family were prepared by both freeze drying and precipitation technique, and their catalytic activities with respect to the oxidation of CO with O_2 were measured in the composite gases. Freeze drying is a new technique for the prevention of migrating of the solutes during drying. Therefore, the corrugated cordierite monolith fabricated with stainless steel bar was directly impregnated with nitrated solutions containing the appropriate cations, freeze dried and calcined. Precipitation was done by using $(NH_4)_2CO_3$ but the precipitated catalysts gave lower catalytic activity than the freeze dried samples due to, in part, relatively high calcining temperature. In this study, freeze dried composition had high catalytic activity, and their apparent activation energy for oxidation of CO was calculated by the rate plots using the data where the percent conversion of CO was less than 20%.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 40244, 40363, 40369, 40988

41083 **(AD-A—104090/6) Multicylinder diesel engine tests with unstabilized water-in-fuel emulsions. Final report Sep 78-July 80.** Coon, C.W. Jr. (Southwest Research Inst., San Antonio, TX (USA)). Jun 1981. Contract DOT-TSC-1587. 155p. NTIS, PC A08/MF A01.

Two diesel engines representative of the four-stroke cycle and two-stroke cycle main propulsion units installed in U.S. Coast Guard WPB class cutters were operated in a test environment in an attempt to demonstrate significant fuel savings associated with water-in-fuel emulsions. The engines were connected to a dynamometer in a laboratory test cell. A prototype fuel system was assembled that would supply unstabilized emulsions for which the water concentration could range form zero to 25 percent of the total volume of liquid supplied to the engine as fuel. An analysis of boat operation was performed in order to identify the most frequently used engine settings, and both engines were operated at test points representative of boat prop load performance. The test results for the four-stroke cycle engine indicated that an average diesel fuel saving of about 2.5 percent could be obtained at the most frequent-

ly encountered operating conditions using water concentrations of 15-25 percent. Statistical analysis procedures suggest a 90 percent confidence in the measured results. Significant reductions in exhaust smoke were also observed, although the exhaust stream opacity was low throughout the tests. For the two-stroke cycle engine, no statistically significant reduction in fuel consumption could be identified.

41084 **(PB—82-101783) Fuel economy and exhaust emissions of a methanol-fueled Chevette.** Ashby, H.A. (Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div.). May 1981. 7p. NTIS, PC A02/MF A01.

This report presents the results of a series of tests conducted over a period of several months on a 1979 Chevrolet Chevette powered by anhydrous methanol. Baseline tests with gasoline were also conducted about three months before the methanol test series began. The exhaust emissions from this car were greatly affected by air-fuel ratio and state of tune. Driveability was not good during most tests when CO met Federal standards. The best optimized adjustments gave a 10 percent better energy efficiency on pure methanol than on gasoline with approximately similar exhaust emission levels.

36 MATERIALS

41085 (CONF-811061—, pp 1-5) **Advanced materials development: a technological response to the critical materials challenge.** Wachtman, J.B. Jr. (National Bureau of Standards, Washington, DC). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

In considering the impact of potential or actual shortages on advanced materials development, it is useful to distinguish between the action that Government might take on a national security basis and actions that individual firms might take for purely economic reasons. The Federal Government has the ultimate responsibility for national security and has a range of alternate actions available to it. These can be classified in two categories: supply-oriented and technical or performance oriented. Supply-oriented actions include foreign policy designed to enhance stability of foreign supplies, encouragement of domestic mining when possible, stockpiling, and the use of the Defense Production Act to establish priorities and allocations. The performance options for dealing with a potential or actual material shortage include: first, economic substitution before the shortage occurs, which I shall term displacement; second, preparation for substitution with means that are presently uneconomic and actual substitution only after a shortage occurs; third, conservation through changes in design and processing; and, fourth, specialized recycling. Displacement is a possible result of work on substitution preparedness since a new material now economically unattractive, and suitably only as an emergency substitute, may, if prices change or technology improves, serve as a displacement before any shortage occurs. Many new materials are being developed at present.

41086 (INIS-SU—61, pp 3-6) **Cascade theory under irradiation in crystals with heavy impurities.** Trushin, Yu.V.; Orlov, A.N.; Evlampiev, I.K. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 7. Bakurianian school on radiation physics of metals and alloys; Bakuriani, USSR (Feb 1979).

In the framework of earlier developed representations the effect of a heavy impurity, not knocked out of a site, on the vacancy V and interstice i distribution, arising in the cascade region under irradiation of a crystal, has been studied. The distribution of defects is calculated under following assumptions: 1) stationarity of the distribution function of moving atoms; 2) cascades do not overlap; 3) V and i concentrations in an initial crystal is low; 4) atomic interaction is pairing with the Lindhardt type cross section. The implantation of a heavy impurity has been shown to lead to a decrease in the cascade efficiency, and the allowance made for prompt recombination still more localizes the cascade.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 40082, 40083, 40084, 40085, 40086, 40087, 40088, 40089, 40093, 40098, 40179, 40181, 40357, 40689, 40690, 40692, 40693, 40694, 40695, 40696, 40697, 40699, 40711, 40827, 40918

41087 **(AD-A—103807/4) Characterization of uranium-3/4% titanium alloys extruded from the gamma phase. Final report.** Saunderson, R.I.; Brook, G.B. (Fulmer Research Inst. Ltd., Stoke Poges (UK)). Jun 1981. Contract DAJA37-79-C-0100. 53p. NTIS, PC A04/MF A01.

High density and tensile properties can be achieved in U-3/4% Ti by water quenching from the gamma phase and subsequently ageing at lower temperature. These high quench rates have been found to give rise to centerline cracking and void formation in medium and large diameter bars (i.e. greater than approximately 20mm diameter). The effects of quench rate, mode of quenching and subsequent ageing treatments on microstructure and properties of a U-3/4 wt% Ti alloy have been investigated. Particular emphasis has been placed upon heat treatment of 35mm diameter, gamma-extruded, bar. Cooling rates in the range 2 - 480/ks were obtained, resulting in a wide spectrum of microstructures ranging from granular alpha after slow rates of cooling to almost fully martensitic alpha prime after faster cooling. By optimising the rate and mode of quenching the problems of centerline cracking and void formation have been circumvented. Even at the fastest cooling rates only approximately half to three-quarters of the available titanium was retained in solution. Nevertheless, subsequent ageing at 450 C produced hardnesses in excess of 480 Hv sub 30 due to precipitation of U2 Ti.

41088 **(BF-R—64.192-1) Optimization of the techonology related to Ge:Be infrared detectors. Final report.** Brunsmann, U.; Fischbach, J.U.; Egle, H.; Frenzl, O. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). Oct 1980. 69p. NTIS PC A04/MF A01.

Crystals of Ge Be covering the doping range between 3 x 10 to the 14th power cu cm and 1 x 10 to the 16th power cu cm, were grown. The materials quality was evaluated by Hall effect, resistivity measurements, emission spectroscopy, photoluminescence and Auger analysis. Detector elements were fabricated, using rubbed-in In Ga contacts and boron ion implanted contacts. A beryllium concentration of 8 x 10 to the 14 the power cu cm is found to yield optimum performance. Partial compensation for shallow traps results in an increased breakdown field strength. A maximum current responsitivy of 2 A/W and a minimum noise equivalent power (40 microns 13 Hz, 1.5 K) 5 x 10 to the minus 16th power W / square root of Hz was obtained at a background photon flux of 3 x 10 to the 8 th power photons per sq cm per sec. (ESA)

41089 (CONF-811061—, pp 30-40) **Rapidly solidified superalloys.** van Reuth, E.C.; Jacobson, L.A. 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The development of superalloys with improved capability has historically depended on the introduction of new processing technologies. Major improvements were realized through the use of vacuum melting, and, more recently, directional solidification of airfoil castings. The new technique, termed Rapid Solidification Rate, or RSR, gives cooling rates in the range of 10^5 to 10^6C/second and has stimulated a large amount of effort to apply rapid solidification processing to a number of other structural alloy systems, most notably, aluminum alloys. It is the purpose of this paper to present the current and near-term planned efforts on RST superalloys, not only for DOD, but for other government agencies as well. Overall objectives and approaches are discussed, and some examples of accomplishments to date are highlighted. The anticipated benefits of rapid solidification processing of superalloys have been described - higher performance, lower cost, less dependence on critical/strategic elements, improved durability, and the ability to use advanced component designs. A major area of concern is the exercise of proper control over all aspects of superalloy powder processing, especially those related to cleanliness, handling, consolidation and forming.

41090 (CONF-811061—, pp II.73-II.75) **Development of automatic GTAW-HW process for field fabrication of thick-walled 2-1/4 Cr-1 Mo pressure vessels.** Nelson, R.L.; Stol, I. (Westinghouse Electric Corp., Tampa, FL). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Base materials were determined by guide lines developed by previous GTAW-HW work. Weld materials specifications were similarly guided by past GTAW-HW usage. In-process NDT techniques consisted of a modified UT procedure which was effectively used throughout. 4 in. thick laboratory parameter qualification assemblies were successfully welded and tested for the 2G, 3G-down, and the 3G-up positions. Plate material for field demonstrations was ordered to a specification tailored for the contract and from the same heat. A detailed assessment was made of the methods, facilities, and services required for the demonstration to closely simulate field fabrication and welding. The demonstration welding equipment was designed and fabricated to a closely written functional specification and was continuously monitored from design through delivery. Testing of the weldments satisfied all contract requirements.

41091 (CONF-811061—, pp III.1-III.10) **Microstructural effects in abrasive wear.** Fiore, N.F.; Kosel, T.H. (Univ. of Notre Dame, IN). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The purpose of this research is to establish quantitative relations between microstructure and wear resistance for highly alloyed white irons and Co-base powder metallurgy (PM) alloys commonly used in coal mining, handling and conversion processes. The applied aspect of this objective, the development of a better understanding of the physical and mechanical metallurgy of wear, is leading to the semi-empirical development of abrasion-resistant alloys of minimal alloy content and heat treatment requirements. On the basic side, understanding of the micro-flow and micro-fracture processes in abrasion is defining the role of such parameters as second-phase size and hardness in wear and is providing the means of alloy design from first principles. The microstructural analysis, which includes automated quantitative metallography, is directed toward establishing quantitative, although perhaps empirical, relations between wear mechanisms and such microstructural parameters as second-phase size, size distribution, shape, orientation and hardness. The wear testing is conducted on laboratory rubber-wheel abrasion and gouging abrasion test systems which have been correlated to field experience, and on a single-point scratch test system which is useful for basic studies.

41092 (CONF-811061—, pp III.11-III.19) **Wear-resistant materials for coal conversion components.** Kelley, J.E. (Bureau of Mines, Albany, OR). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

It is concluded from the ball-valve tests that white cast iron, HC-250, and METCO 36C coatings can be used for ball valve seats in lock-hopper applications where moderate temperatures solids such as coal ash are transferred. A promising material for ball-valve balls for the same service is METCO 19E coating. Limited testing of laser-processed METCO coatings suggest that equal wear resistance to flame-processed coatings can be expected.

41093 (CONF-811061—, pp III.32-III.39) **Analysis of hydrogen attack in pressure vessel steels.** Odette, G.R. (Univ. of California, Santa Barbara). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Steels used in coal conversion vessels are exposed to hydrogen at high temperatures and pressures (T ~ 450°C and P/sub H_2/ ~ 15 MPa). Under these conditions hydrogen readily diffuses into the metal matrix and reacts with carbon at internal surfaces to form methane. This phenomenon, known as hydrogen attack (HA), results in internal decarburization and the nucleation, growth and eventual coalescence of grain boundary cavities; these microstructural changes, in turn, result in severe degradation of mechanical properties. Hence, HA may be a serious failure mechanism for thick-walled pressure vessels. Selection of safe hydrogen pressure and temperature limits has been based on the empirical Nelson Curve; these curves have been developed for various broad alloy classes and qualitative failure criteria. However, because of extremely limited data and operating experience under the conditions pertinent to coal conversion technologies, and probable requirements for fail-safe operation, Nelson curves do not appear to be adequate for designing thick-walled pressure vessels. The purpose of this research is to develop physical models of the HA process describing important mechanisms and containing pertinent environmental and metallurgical parameters. These models are then used to correlate engineering and laboratory data, and to extrapolate the data to predict HA behavior under actual vessel service conditions.

41094 (CONF-811061—, pp III.40-III.47) **Hydrogen attack in Cr-Mo steels at elevated temperatures.** Li, C.Y. (Cornell Univ., Ithaca, NY). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The objective of this program is to determine the kinetics of nucleation and growth of methane bubbles or cavities in 2 1/4 Cr-1 Mo steels (primarily ASTM 387) at elevated temperatures under the influence of high pressure hydrogen and applied stress and to develop kinetic equations for estimating the number density and size distribution of grain boundary cavities as a function of time under conditions of interest to coal conversion plant operations.

41095 (CONF-811061—, pp III.48-III.53) **Study to optimize Cr-Mo steels to resist hydrogen and temper embrittlement.** Shaw, B.J. (Westinghouse R and D Center, Pittsburgh, PA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The objective of this program is to evaluate the effect of composition on the susceptibility of Cr-Mo steels to hydrogen and temper embrittlement. The program is divided into two phases. Phase I is a study of the hydrogen embrittlement susceptibility of commercial steels supplied by the American Petroleum Institute. Phase II is a study of both the temper and hydrogen embrittlement of 32 laboratory steels with compositional variables Mo, Cr, Mn, Si, C and P arranged according to a statistical design. The object of this phase is to establish the effect of strength level and composition on the two forms of embrittlement. The primary objective is to evaluate a range of Cr-Mo steels in order to assess the role of compositional variables on the susceptibility to hydrogen and temper embrittlement.

41096 (CONF-811061—, pp III.54-III.67) **Characterizing and improving the toughness of thick-sectioned 2 1/4-Cr 1 Mo electroslag weldments.** Edwards, G.R.; Frost, R.H. (Colorado School of Mines, Golden). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Electroslag welding has been a particularly appealing process for thick-section welding because of the high deposition rate. Application of the process is currently hindered, however, by lack of a fundamental understanding of the critical process variables, the influence of flux chemistry and electrochemical reactions on process chemistry, and the influence of thermal history and post-weld heat treatment on the ductility of the fusion and heat-affected zones. The objective of this program is to characterize the effects of process variables, process chemistry, and thermal history, and to apply that knowledge in optimizing the properties of 4-in.-thick 2 1/4 Cr - 1 Mo electroslag weldments. The major research efforts have been focused on three areas: (1) a theoretical understanding of process variable influence and control; (2) an evaluation of the influence of electrochemical reactions on process chemistry; and (3) a study of the effects of post-weld heat treatment and process chemistry on the mechanical properties of the weld fusion zone.

41097 (CONF-811061—, pp III.89-III.101) **New class of steels for thick wall pressure steels.** Parker, E.R. (Univ. of California, Berkeley). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Isothermal transformation studies have shown that the interphase precipitation reaction $\gamma \rightarrow \alpha + VC$ will produce a dispersion of spherical VC particles at temperatures above the nose of the C-curve (e.g., 700°C, Figure 1). Below the nose of the C-curve (650°C, Figure 1) rows of closely spaced particles or fibers are observed. The latter morphology has very poor impact toughness. Both types of VC precipitates are shown in Figure 2. Earlier research has shown that excellent combinations of strength and impact toughness can be achieved in isothermally transformed microstructures which contain the spherical precipitate dispersion. Recent results have shown that it is also possible to produce such an optimum microstructure in continuously cooled Fe-C-V alloys. In order to produce the interphase precipitation reaction with optimum VC morphology, slow cooling rates are important to avoid the formation of pearlite and bainite. Several factors are important in determining the nature and kinetics of the interphase precipitation reaction. These include: composition and austenitizing temperatures. An optimum composition Fe - 0.2C - 1.0 V - 0.5 Mn - 1.5 Ni has been developed which will produce a spherical distribution of VC particles giving excellent combinations of strength and toughness throughout the thickness of slowly cooled plate.

41098 (CONF-811061—, pp III.113-III.115) **X-ray study of residual stresses in narrow groove TIG weldments.** Ruud, C.O. (Pennsylvania State Univ., University Park, PA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The objective is to develop reliable, economical methodologies for the measurement of three-dimensional stress contours in heavy plate weldments and to apply these to the comparison of stress fields resulting from conventional vee groove and narrow gap welding methods. Also, to measure the effectiveness of postweld treatments for the reduction of residual stresses. A literature search has developed the information necessary to qualitatively predict the nature and distribution of the three-dimensional, as-welded, residual stress fields in thick low alloy steel weldments. Also, this information was used in conjunction with stress relaxation calculations to prescribe the most reasonable methodology of stress measurement and specimen sectioning for accurate residual stress measurement. The design and fabrication of the x-ray stress instrument is nearly complete and is scheduled for testing in July. The data processing software has been tested upon fabricated data using a computer and operating system similar to the one dedicated to the stress analyzer. The apparatus for manipulating the x-ray head to provide rapid precise translation and indexing has been designed and built.

41099 (CONF-811061—, pp III.128-III.133) **Dissimilar weld failure analysis and development.** Prager, M. (Metal Properties Council, Inc., New York, NY); Roberts, D.; Ellis, F. 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Dissimilar metal welds are widely used to join lengths of ferritic steel to austenitic stainless steel tubes in superheaters and reheaters of central power station boilers. Typically, the welds operate at approximately 538°C in both heat transfer and nonheat transfer regions. An increasing number of these welds have failed in recent years, causing a significant number of forced outages. A recent survey has concluded that the problem is urgent and of such magnitude that it warrants a large-scale R and D effort. It is generally believed that the failures have been caused by low-cycle or thermal fatigue, with the stresses caused by the mismatch of the thermal expansion and conductivity between the ferritic steel tube and the adjacent weld deposit contributing to the cracking. Added to these differences in thermal property characteristics are the normal operating loads of internal pressure, radial and circumferential thermal gradients, and external loads from piping-system movements. These factors, combined with the metallurgical instability in the weld-heat-affected zone where cracking usually occurs have complicated the development of a clear understanding of the failure mechanism. For every explanation of the failure mechanism that has been offered, exceptions have been noted. To correct the current situation the following tasks were defined: analysis of the causes of dissimilar weld failures; analysis of dissimilar metal weldments with fossil fired boiler service; simulation of metallurgical changes in dissimilar welds during service; stress analysis of dissimilar welds; development of an accelerated laboratory test to discriminate between welds; and development of recommendations for improved fabrication transition welds.

41100 (CONF-811061—, pp V.12-V.16) **Hot corrosivity of coal conversion products on high temperature alloys.** Meier, G.H.; Gulbransen, E.A.; Stoehr, R.A. (Univ. of Pittsburgh, PA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Thermodynamic data have been collected on oxides, sulfides, carbides and nitrides of the metallic elements of interest in high temperature corrosion, and in the construction of isothermal stability diagrams and vapor species diagrams over the temperature range 1150 to 1450°K. An electrochemical cell (described) has been used to study changes in the chemistry of Na_2SO_4 pertinent to hot corrosion reactions and to determine the solubility of various oxides in Na_2SO_4. Hot corrosion studies of high temperature alloys have concentrated on two major problems: the so-called low-temperature hot-corrosion which occurs in the temperature range 700 to 800°C and is associated with sulfate deposits and high SO_3 partial pressures ($>10^{-5}$ atm) in the gas phase and the problem of corrosion by nominally solid deposits such as CaO, $CaSO_4$, and MgO which can occur in coal conversion systems, particularly fluidized bed combustors. In the area of corrosion due to solid deposits, a number of alloys have been exposed to CaO, $CaSO_4$ and MgO deposits in pure O_2. (LTN)

41101 (CONF-811061—, pp V.92-V.103) **Elimination of impurity-induced embrittlement in steels.** McMahon, C.J. Jr.; Pope, D.P.; Takasugi, T.; Chen, S.; Zhe, Q.; Shin, J.C. (Univ. of Pennsylvania, Philadelphia). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

This program is aimed at documenting and understanding the effects of impurity elements, alloy composition, and microstructural variables on embrittlement of alloy steels used in turbine and generator rotors and in pressure vessels. The embrittlement phenomena include temper embrittlement, creep embrittlement, and stress relief (or reheat) cracking. The steels presently under study include 1 CrMoV and 3.5 NiCrMoV rotor steels and A533-B and A508-2 pressure vessel steels. The program involves the following activities: analysis of the temper embrittlement behavior of several 1 CrMoV rotors; temper embrittlement studies on nine laboratory heats of 1 CrMoV steel with varied amounts of P, Sn, Mn and Si to determine the effects of these compositional variations and, if possible, an embrittlement equation which relates FATT to intergranular impurity concentration, hardness, and grain size; temper embrittlement studies of laboratory heats of 3.5 NiCrMoV with various combinations of Mn, Sn, and P to relate their behavior to the 3.5 NiCr heats studied previously and to determine the applicability of the previously-determined embrittlement diagram; stress-rupture studies of four of the laboratory heats of 1 CrMoV to determine how variations in the Mn, P and Sn concentrations act to control the rupture ductility; and development of the method of characterization of stress relief cracking in A533-B and A508-2 pressure vessel steels and study of the mechanisms of such cracking. Results to date are described and discussed.

41102 (CONF-811061—, pp VI.85-VI.92) **Design properties of steels for coal conversion vessels.** McCabe, D.E.; Landes, J.D. (Westinghouse R and D Center, Pittsburgh, PA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Cracked specimens of the standard compact geometry were tested under a rising load technique to identify the onset of environmentally assisted crack growth. The method uses a comparison of test records made in the environment to baseline test records developed under benign conditions. First deviation indicates onset of environmental crack growth and this is used to obtain a tentative estimate of K/sub Iscc/. For rising load tests (in 6% H_2S-Bal H_2) at

room temperature, all the metallurgical conditions tested of 2 1/4 Cr-1 Mo showed K/sub Iscc/ of about 1/4 to 1/3 of baseline behavior, K/sub Ic/. A similar set of tests conducted at 588°K (600°F) showed that 2 1/4 Cr-1 Mo steels develop an immunity to environmental cracking. However, a series of tests made at 727°K developed a behavior characteristic which has been termed environmentally assisted plasticity. Here the load carrying capacity of specimens is reduced about 25 percent without significant accompanying crack advance. To further evaluate the effects of environment on high temperature deformation, tests were conducted under long time sustained loads in environment at 727°K and results compared with a similar test in air. Under sustained load the specimens exhibited a creep like deformation with no significant accompanying crack advance. These results show that the 6% H_2S-Bal H_2 environment significantly increased the displacement rate over that measured in air at 727°K but a pure H_2 environment appeared to retard the displacement rate. Fatigue crack growth tests were also conducted in the 6% H_2S-Bal H_2 environment at 727°K and compared with results in air.

41103 **(CONF-820314—6) Compatibility of stainless steel with Pb-17 AT. % Li.** Tortorelli, P.F.; DeVan, J.H. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE82008828.

From National Association of Corrosion Engineers conference; Houston, TX, USA (22 Mar 1982).

The corrosion of type 316 stainless steel and Sandvik HT9 by static Pb-17 at. % Li between 300 and 500°C was studied. The resulting weight losses were significantly greater than those of these steels in lithium. The corrosive attack was very uniform, and the room-temperature tensile properties of the steels were unaffected by the exposure. The application of molten Pb-17 at. % Li as a tritium-breeding fluid in conjunction with ferrous alloys in a fusion reactor may be limited to 400°C or below.

41104 **(DOE/ER/10429—3) Atomistic studies of grain boundaries with segregrated impurities. Progress report, July 1, 1981-June 30, 1982.** Vitek, V. (Fluor Engineers and Constructors, Inc., Los Angeles, CA (USA)). Feb 1982. Contract AS02-79ER10429. 15p. NTIS, PC A02/MF A01. Order Number DE82008459.

In this research project atomistic studies of grain boundaries with substitutional impurities are described. The rationale for this investigation is the fact that segregation of solutes to grain boundaries affects very strongly many material properties such as cohesion, grain boundary diffusion, rates of recrystallization, etc. The atomistic calculations have been carried out in the first place for the low concentrations of solutes in the boundaries. The systems investigated are Cu-Bi, Cu-Ag and Au-Ag.

41105 **(DOE/ER/10464—T1) Study of electrons photoemitted from field-emission tips. Progress report, July 1, 1982-June 30, 1983.** Reifenberger, R. (Purdue Univ., Lafayette, IN (USA). Dept. of Physics). Jan 1982. Contract AS02-79ER10464. 25p. NTIS, PC A02/MF A01. Order Number DE82011719.

Photo-induced field emission is a technique which studies electrons that have been photoemitted from a field emission tip. This experimental method promises to combine the proven utility of both field emission and photoemission for investigating the electronic states near a metal surface. The primary objective of the reseach decribed in this proposal is to measure photo-induced field emitted electrons as a function of both their final state energy and the applied electric field. An Argon-ion laser in conjunction with a tuneable cw dye laser will be used to photo-excite the electrons. A differential energy analyzer will allow energy resolved measurements of the photo-field emitted electrons. Other experiments, directly related to the unique effects associated with the illumination of metallic tips by laser light, are also proposed. Experiments that exploit the large tempeature rise of a field emission tip when illuminated by a focussed laser beam are proposed to study thermally activated surface diffusion of alkali adatoms on a field emission tip. These experiments may eventually provide information about thermally-induced or laser-induced chemical reactions on small metallic surfaces.

41106 **(EGG-M—03182) Effect of simulated medium-Btu coal gasifier atmospheres on the biaxial stress rupture behavior of four candidate coal gasifier alloys.** Horton, R.M.; Smolik, G.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 23p. (CONF-820205—3). NTIS, PC A02/MF A01. Order Number DE82008607.

From 111. AIME annual meeting; Dallas, TX, USA (1 Feb 1982).

Tests were conducted to determine whether the biaxial stress rupture behavior of four alloys was adversely affected by exposure to four simulated medium-Btu coal gasifier atmospheres. The results of exposures up to approximately 500 h at temperatures between 649 and 982°C are presented. Exposure to these atmospheres at temperatures below 900°C did not significantly reduce the rupture properties from those measured in air. Only at 982°C were the rupture strength and life in the simulated coal gasifier atmospheres lower than those measured in air at atmospheric pressure. Possible reasons for this reduction in strength/life are discussed. The results of detailed examination of specimen ruptures are also presented.

41107 **(EUR—7446-FR/DE) Study of the behavior of hydrogen. Final report. Final report in the principal European steels used in the fabrication of vessels for transport and storage of gaseous hydrogen.** (L'Air Liquide, 78 - Les Loges-en-Josas (France). Centre de Recherche Claude-Delorme). 1981. 156p. (In French and German). Commission of the European CommunitiesDirectorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

For this study we have used as test pieces imbedded disks deformed under gas pressure. Most tests have been carried out by dynamic rupture technique (deformation until rupture), other by delayed rupture technique (deformation until pressure below the dynamic rupture pressure, then wait until the rupture at static pressure). Some exploratory permeation and symmetrical plastic fatigue tests have also been carried out with the same type of test-piece (disk). Selected materials for our study are quenched and tempered steel grades 35 CD4, 30 CD10, 34 CrMo4, 28 Mn6 and 20 CND10, with two different states of heat treatment for the three first grades. Main results have been obtained by dynamic rupture tests; we have defined different criterions which have allowed us to compare the hydrogen behaviour of different steels; it appears that for a given steel, hydrogen embirttlement decreases: when tempering temperature increases (for a fixed quenching) and when hydrogen pollution (oxygen or water vapor) increases. Moreover these tests put in evidence that the empiric limit of 950 MPa for the tensile strength of hydrogen vessels steels, is more severe for 35 CD4 steels than for 30 CD10 steels. Finally it seems necessary to carry on this study in developing new fatigue tests and in conducting tests with check materials (good or bad) to clearly and logically define the different materials limit of utilization.

41108 (IA—1364, pp 129-130) **Hydrogen embrittlement of carbon steels in hot alkali nitrite solutions.** Nothman, R.; Rosenberg, K.; Aladjem, A. Jul 1981. Dep. NTIS (US Sales Only).

In Research laboratories annual report 1980.

41109 (INIS-SU—61, pp 95-102) **Effect of reactor irradiation on pinning in TaNb superconducting alloy.** Magradze, O.V.; Tsakadze, D.S.; Chigvinadze, D.G. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 7. Bakurianian school on radiation physics of metals and alloys; Bakuriani, USSR (Feb 1979).

An analysis is presented of the data on the effect of reactor irradiation on the Abrikosov vortex pinning for different superconducting alloys. In particular, the effect of irradiation and of subsequent annealing on pinning is described for a strongly deformed crystal of the $Ta_{70}Nb_{30}$ alloy. The mechanical method for measuring has been applied. It is found that 1) pinning is absent in a strongly deformed alloy; 2) fast neutron irradiation by the 10^{18} n/cm^2 dose produces effective pinning centers; 3) annealing at 300 K for 900 hr increases the pinning force by three times approximately; 4) location of the second peak of the pinning force in the vicinity of magnetic fields Hsub(C2) is independent of the annealing time. It is

concluded that irradiation produces zones of shift, and annealing initiates polygonization of the dislocation grid structure.

41110 **(PB—81-182875) Strain scaling law and the prediction of uniaxial and bending strain effects in multifilamentary superconductors. Final report.** Ekin, J.W. (National Bureau of Standards, Washington, DC (USA)). 1980. 17p. Pub. in Proceedings of the Topical Conference Held at Upton, NY., on May 28-29, 1980, Paper in Filamentary A15 Superconductors, p187-203 1980.

The strain-scaling law has been used to determine uniaxial-strain characteristics which describe the critical-current degradation in commercial multifilamentary Nb3Sn conductors from 4 T to 16 T. Bending-strain degradation has then been calculated from the uniaxial-strain characteristics by taking an average appropriate for the twist-pitch to current-transfer-length ratio of the conductor.

41111 **(PB—81-201956) Study of materials to resist corrosion in condensing gas fired furnaces. Annual report Oct 79-Oct 80.** Lahtvee, T.; Khoo, S.W.; Schaus, O.O. (Canadian Gas Research Inst., Don Mills, Ontario). Feb 1981. 130p. NTIS, PC A07/MF A01.

Based on a thorough review of background information on the performance of materials in condensing gas-fired furnace heat exchangers and in similar corrosive environments, candidate materials were selected and tested on one of two identical test rigs built to provide the varying corrosive conditions encountered in an actual gas-fired condensing system heat exchanger. The 32 different materials tested in a one month screening test included: mild, low alloy, galvanized, solder coated and CaCO3 dipped galvanized steel, porcelain, epoxy, teflon and nylon coated and alonized mild steel; austenitic, ferritic, low interstitial Ti stabilized ferritic, and high alloy stainless steels; aluminum alloy anodized and porcelain coated aluminum; copper and cupronickel alloys, solder coated copper; and titanium.

41112 **(PB—81-854077) Liquid metals. January 1970-October 1980 (citations from the NTIS Data Base). Report for January 1970-October 1980.** (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 205p. NTIS PC N01/MF N01.

The information covers studies, processes and applications of liquid metals. Studies on dynamic structures, conductivity, electronic properties, heat flow, liquid metal flows, convective heat, mass heat transfer, and thermodynamic properties are also included. (Contains 173 citations, fully indexed and including a table of contents.)

41113 **(PB—81-854085) Liquid metals. January 1976-October 1980 (citations from the Energy Data Base). Report for January 1976-October 1980.** (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 190p. NTIS PC N01/MF N01.

Worldwide information covers studies, processes, and applications of liquid metals. Studies on dynamic structures, conductivity, electronic properties, heat flow, liquid metal flows, convective heat, mass heat transfer, and thermodynamic properties are also included. (Contains 181 citations, fully indexed and including a table of contents.)

41114 **(PB—81-854093) Liquid metals. January 1970-October 1980 (citations from the Engineering Index Data Base). Report for January 1970-October 1980.** (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 187p. NTIS PC N01/MF N01.

Worldwide information covers studies, processes and applications of liquid metals. Studies on dynamic structures, conductivity, electronic properties, heat flow, liquid metal flows, convective heat, mass heat transfer, and thermodynamic properties are also included. (Contains 193 citations, fully indexed and including a table of contents.)

41115 **(PB—81-854101) Liquid metals. January 1972-October 1980 (citations from the International Aerospace Abstracts Data Base). Report for January 1972-October 1980.** (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 138p. NTIS PC N01/MF N01.

Worldwide information covers studies, processes and applications of liquid metals. Studies on dynamic structures, conductivity, electronic properties, heat flow, liquid metal flows, convective heat, mass heat transfer and thermodynamic properties are also included. (Contains 131 citations, fully indexed and including a table of contents.)

41116 **(PB—81-855736) Bubble chambers. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 204p. NTIS PC N01/MF N01.

The citations cover worldwide research reports and applications of bubble chambers, processing of super heated liquids and elements, and the controlling of bubble chambers. Processes by photographic, scanning and computerized equipment are also included. (Contains 200 citations, fully indexed and including a table of contents.)

41117 **(PB—81-863466) Indium antimonide: physical properties. January, 1966-May, 1981 (citations from the Metals Abstracts Data Base). Report for January 1966-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 73p. NTIS PC N01/MF N01.

The physical properties of indium antimonide are considered with emphasis on the applications of this compound to photovoltaic and piezoelectric devices. Other applications include ultrasonics and acoustic devices. In addition, the temperature dependence of sound velocity and x-ray reflectance are considered. (Contains 105 citations fully indexed and including a title list.)

41118 **(PB—81-866527) Crystal defects: superconductors. January, 1966-May, 1981 (Citations from the Metals Abstracts Data Base). Report for January 1966-May 1981.** (General Services Administration, McLean, VA (USA). Mathematics and Computation Lab.). May 1981. 55p. NTIS PC N01/MF N01.

The effect of crystal defects on the properties of superconducting materials is considered. Particular emphasis is placed on radiation damage and its effect on electrical and magnetic properties as well as phase transformations and plastic deformation. (Contains 80 citations fully indexed and including a title list.)

41119 **Influence of electron concentration on the hydrogen absorption by RM_5 Haucke compounds.** Gschneidner, K.A. Jr.; Takeshita, T.; McMasters, O.D. (Iowa State Univ. of Science and Technology, Ames (USA)); Chung, Y. (Ames Lab., IA (USA)). *Journal of Physics F: Metal Physics;* **12**: No. 1, L1-L6(Jan 1982).

Analysis of the electronic specific heat constant for some $Y(Ni,Al)_5$, $La(Ni,Al)_5$, $La(Ni,Cu)_5$ and $Th(Ni,Al)_5$ alloys suggests that the amount of hydrogen absorbed in excess of 3 H atoms per RM_5 formula unit (0.5 H atom per metal atom) by the RM_5 phases depends upon the number of unpaired 3d nickel electrons. The so-called 'aluminium anomaly' is also explained on the basis of these results.

41120 **Magnetic susceptibility of the TaV_2/H_2 system.** Lynch, J.F. (Brookhaven National Lab., Upton, NY (USA)); Lindsay, R.; Moyer, R.O. Jr. (Trinity Coll., Hartford, CT (USA)). *Solid State Communications;* **41**: No. 1, 9-13(Jan 1982).

The magnetic susceptibility exhibited by the ordered (C-15) and random bcc allotropes of TaV_2 decreases linearly with increasing hydrogen content. However, the susceptibility exhibited by the (C-15) form is about four times more sensitive to hydrogen than that exhibited by the bcc form. The results are in qualitative accord with the thermodynamics of hydrogen solution.

41121 (NUREG/CR—2317-Vol.1NOS.1-2) Container assessment - corrosion study of HLW container materials. Quarterly progress report, April-June 1981. Ahn, T.M.; Lee, B.S.; Soo, P. (Brookhaven National Lab., Upton, NY (USA)). Dec 1981. Contract AC02-76CH00016. 13p. (BNL-NUREG—51449). NTIS, PC A02/MF A01. Order Number DE82008455.

A research program on container assessment has been initiated to determine the general and localized corrosion mechanisms in high level waste container materials such as titanium, copper, and lead. In this quarter, our efforts have been on the initiation of a program establishing specific experiments pertaining to uniform corrosion, crevice corrosion, pitting corrosion, stress corrosion, hydrogen embrittlement, radiation effects, vapor-solution-container wall interaction, and an analytical study. Preliminary tests have been performed for the uniform and crevice corrosion of copper and titanium in brine at 150°C.

41122 Theoretical evaluation of a mechanism of precipitate-enhanced cavity swelling during irradiation. Mansur, L.K. (Oak Ridge National Lab., TN (USA)). *Philosophical Magazine, [Part] A: Defects and Mechanical Properties;* **44**: No. 4, 867-877(Oct 1981).

It is often observed experimentally in complex alloys, such as the austenitic stainless steels, that the largest cavities produced during irradiation are attached to second-phase precipitate particles. One hypothesis that such observations suggest is that the precipitate-matrix interface may assist in the collection of irradiation-produced point defects which are channelled to the attached cavities. A theoretical analysis is developed to evaluate this mechanism. It is found that the growth of cavities attached to precipitates is increased compared to the growth of cavities in the matrix. The relative growth rates of the two types of cavity are also affected by differences in bias and differences in sink strength. The relationships required to evaluate these effects are developed and the consequences of enhanced point-defect collection are explored in some detail. For the parameter range of interest, it is found by calculation that the cavity attached to the precipitate may grow several times larger than the cavity isolated in the matrix. Simple experiments are suggested and the expected results are described for comparison.

41123 Phonon-limited lifetimes of electrons in Pd. Khan, F.S.; Allen, P.B. (State Univ. of New York, Stony Brook (USA). Dept. of Physics); Butler, W.H. (Oak Ridge National Lab., TN (USA)). *Physica B+C (Amsterdam);* **108**: No. 1-3, 893-894(Aug-Sep 1981).

From 16. international conference on low temperature physics; Los Angeles, CA, USA (19 - 25 Aug 1981).

Quasiparticle lifetimes 1/tausub(k) are calculated for electrons on the Fermi surface (FS) of Pd using the rigid muffin tin model. Results are presented for the GAMMA-centered and the open sheets.

41124 Superconducting and transport properties of NbTi layered metals. Zheng, J.Q.; Ketterson, J.B. (Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy; Northwestern Univ., Evanston, IL (USA). Materials Research Center); Falco, C.M.; Schuller, I.K. (Argonne National Lab., IL (USA)). *Physica B+C (Amsterdam);* **108**: No. 1-3, 945-946(Aug-Sep 1981).

From 16. international conference on low temperature physics; Los Angeles, CA, USA (19 - 25 Aug 1981).

We report data on the superconducting transition temperature and room temperature resistivity of layered NbTi for thicknesses in the range 7-70 A.

41125 Suppression of irradiation swelling through an impurity-point defect trapping mechanism involving reduction of the dislocation bias factor. Weertman, J.; Parkin, D.M. (Los Alamos National Lab., NM (USA)). *Journal of Nuclear Materials;* **99**: No. 1, 66-74(Jul 1981).

The reduction of void growth through the addition of alloying elements generally is attributed to a point defect trapping mechanism that alters profoundly the annealing kinetics of the mutual annihilation of point defects and the migration of point defects to dislocation and void sinks. Another mechanism by which alloying atoms might be able to reduce void growth is through changes in the dislocation bias factor. In this paper it is shown by means of a greatly simplified analysis that alteration of the dislocation bias factor can produce a void growth reduction as large or larger than that produced through changes in the annealing kinetics.

41126 Anisotropic growth of reactor fuel pin cladding. Bates, J.F.; Cummings, W.V.; Gilbert, E.R. (Hanford Engineering Development Lab., Richland, WA (USA)). *Journal of Nuclear Materials;* **99**: No. 1, 75-84(Jul 1981).

Anisotropic growth of 316 stainless steel reactor fuel pin cladding was found to occur after irradiation in the Experimental Breeder Reactor-II (EBR-II). Pressurized tube specimens were irradiated to a peak fluence of 10^{23}n/cm^2 (E > 0.1 MeV) at temperature ranging from 430°C to approximately 590°C. Growth was observed in both the annealed and 20% cold worked conditions and was found to decrease with increasing hoop stress. The anisotropic growth is more pronounced in the cold worked condition. The growth is attributed to a preferred orientation of Burgers vectors in the preirradiated cold worked dislocation structure.

41127 80 MeV proton damage in tungsten and molybdenum: A field-ion microscope observation. Inal, O.T. (New Mexico Inst. of Mining and Technology, Socorro (USA). Dept. of Metallurgical and Materials Engineering); Sommer, W.F. (Los Alamos Scientific Lab., NM (USA)). *Journal of Nuclear Materials;* **99**: No. 1, 94-99(Jul 1981).

0.075 mm tungsten and molybdenum wires were irradiated with 800 MeV protons at an ion current of 5-8 μ Angstroem for 10 days (240 h) at ambient temperature. Following irradiation, field-ion-microscope analyses were made at 78 K utilizing an exchange medium of helium plus 10% neon. Tungsten samples show a few vacant lattice sites as well as a defect zone, approximately 120 Angstroem in diameter and 4-5 atom layers deep, believed to be a radiation induced void, following a calculated damage level of 0.13 dpa. Molybdenum samples exhibit excessive numbers of vacancies and vancancy clusters although no defect larger than approximately 50 Angstroem is seen at a calculated damage level of 0.07 dpa. This could possibly be due to lack of clear atomic resolution obtained in (110) of molybdenum when imaged at 78 K.

41128 Retrospect on 15 years of research on radiation induced interstitial atoms in metals. *IFF (Institut fuer Festkoerperforschung) Bulletin;* **19**: 1-81(Jun 1981). (In German and English).

Within the research program on radiation effects at the IFF, the study of the properties of selfinterstitial atoms in pure metals has been for many years one of the major objectives. Because of the forseen change in our research goals towards defects in more complex alloy systems these studies will fade out in the near future. At this turning stage it therefore seems to be appropriate to review what has been learned and what questions are still open.

41129 Granulation of metals and slags for waste disposal and storage. Copeland, G.L.; Heshmatpour, B. (ORNL, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **38**: 129-130(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41130 Effects of strain rate on deformation-induced martensite 304 steinless steel. Staudhammer, K.P. (Los Alamos Scientific Lab., NM); Frantz, C.E.; Hecker, S.S.; Murr, L.E. pp 91-112 of Shock waves and high-strain-rate phenomena in metals. Meyers, M.A.; Murr, L.E. (eds.). New York, NY; Plenum Publishing Corporation (1981).

Sheet specimens of 304 stainless steel were tested in uniaxial tension over a temperature range of -173 to +100°C at low strain rate (10^{-3}/s) and high strain rate (10^3/s). Two shock loading experiments were conducted; one at -105°C and one at ambient temperature. The amount of strain-induced α′ martensite was measured magnetically, the temperature increase during deformation was measured with a thermocouple, and the substructure was examined by transmission electron microscopy. At room temperature and

small strain levels, more α' martensite was produced at high rate than at low rate. At strains > 0.25, low-rate deformation produced significantly more α' martensite. Tests over a range of temperatures showed that the decrease in α' at large strains and high strain rates resulted from an increase in temperature due to adiabatic heating. Microstructurally, it was found that α' nucleates at shear band intersections. At high rate, there are more shear bands, but the growth of the α' embryos is restricted by the temperature increase. During shock loading, α' martensite formed at both tests temperatures, thereby demonstrating that transformation is possible at such high rates, and under the predominantly compressive stress state.

41131 **Differences in oxides on large- and small-grained 304 stainless steel.** Baer, D.R.; Merz, M.D. (Pacific Northwest Lab., Richland, WA). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **11A**: 1973-1980(Dec 1980). Contract AC06-76RL01830.

The oxides formed on large-grained (~ 40 μm) and small-grained (~ 4 μm) 304 stainless steel oxidized in air at 800°C have been examined and compared by Auger electron spectroscopy to learn more about the role of grain boundaries in the oxidation of the materials. For vacuum preannealed specimens, relatively thick iron oxides formed over the grains and thin, chromium-rich oxides formed over grain boundaries of large-grained material. The oxide formed over the entire surface of the small-grained material was a thin chromium-rich layer similar to that formed over grain boundaries of the large-grained samples. The oxidation of both small- and large-grained samples was consistent with selective formation of Cr_2O_3 at grain boundaries followed by a lateral diffusion of Cr and spreading of Cr_2O_3. A protective Cr_2O_3 layer formed readily on small-grained material but not on large-grained preannealed specimens, oxide morphologies were similar for small- and large-grained material when the outer surface layer was removed by polishing after annealing and before oxidation tests. Surface differences, not adequately defined by Auger and SEM studies, caused marked changes in oxide morphologies for large-grained material. The difference in oxidation behavior before and after polishing was attributed to enhanced oxidation at grain boundaries during the vacuum preannealing treatment and to differences in defect concentrations in the surface region.

41132 **Electron microscopy of Co/Fe/B/Si amorphous alloys.** Rabenberg, L. (Univ. of California, Berkeley); Mishra, R.K.; Thomas, G.; Kohmoto, O.; Ojima, T. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **MAG-16**: No. 5, 1135-1137(Sep 1980). Contract W-7405-ENG-48.

Changes in magnetic structures with annealing are studied using Lorentz electron microscopy and are correlated with changes in magnetic properties for the $Co_{71.4}Fe_{4.6}Si_{9.6}B_{14.4}$ amorphous alloy. Domain wall stablization is shown to be the dominant factor resulting in decreasing μ and increasing H/sub c/ and K during low temperature annealing. Annealing near T/sub c/ results in an isotropic magnetic structure due to domain wall relaxation, and annealing above T/sub cry/ results in magnetically hard crystalline particles. It is concluded that treatments capable of producing a magnetically isotropic structure can produce the best soft magnetic materials.

41133 **Thermodynamic investigation of the Li-Al and Li-Pb systems by the hydrogen titration method.** Veleckis, E. (Argonne National Lab., IL). *Journal of the Less-Common Metals;* **73**: 49-60(1980).

The method was tested on two lithium-based systems, Li-Al and Li-Pb. The results verified the validity of the hydrogen titration method by showing that (1) the hydriding reaction is reversible, (2) the anticipated intermediate phases are correctly identified, and (3) there is a good agreement with the available e.m.f. data on the chemical potentials of lithium in these alloys. For the α + B field of the Li-Al system the lithium activity, calculated from the combined HTM and e.m.f. data, is represented by ln α/sub Li/ = 2.662 to 5302T^{-1}. For the Li-Pb system, HTM results indicated the existence of a new phase having a stoichiometry between $Li_{22}Pb_5$ and Li_7Pb_2. Criteria for applying the HTM to other alloy systems are discussed. 3 figures, 2 tables.

41134 **Ultrasonic characterization and microstructure of stainless steel weld metal.** Kupperman, D.S.; Reimann, K.J.; Kim, D.I. (Argonne National Lab., Il). pp 199-216 of Nondestructive evaluation: microstructural characterization and reliability strategies. Buck, O.; Wolf, S.M. (eds.). New York, NY; American Institute of Mechanical Engineers (1980).

From Proceedings of a symposium sponsored by the Physical Metallurgy Committee of the Metallurgical Society of AIME and the Energy and Resources Activity of the American Society for Metals at the TMS fall meeting; Pittsburgh, PA, USA (5 Oct 1980).

One of the most difficult materials to inspect or characterize ultrasonically is austenitic stainless steel weld metal. The problems arise because of the preferred orientation associated with the columnar grains that are present. This structure is highly anisotropic and, as a result, the sound velocity and attenuation in the weld can vary with propagation direction, by as much as approximately 20% for longitudinal and approximately 100% for shear waves. Experimental results compare favorably with model calcuations. The phenomenon of beam deviation in anisotropic materials is also discussed. Theoretical predictions and experimental results for velocity, attenuation, and the deviation of longitudinal and shear waves in several stainless steel weld metal samples are compared. Predicted deviations of up to 20° for longitudinal waves and 45° for shear waves have been confirmed experimentally. The consequences for attenuation and flaw detection are discussed.

41135 **Elemental microanalysis using analytical electron microscopy.** Zaluzec, N.J. (Argonne National Lab., IL). pp 141-164 of Phase stability during irradiation. Holland, J.R.; Potter, D.I.; Mansur, L.K. (eds.). New York, NY; American Institute of Mechanical Engineers (1980).

From Proceedings of a symposium sponsored by the Nuclear Metallurgy Committee at the fall meeting of the Metallurgical Society of AIME; Pittsburgh, PA, USA (5 Oct 1980).

The microstructure of today's technologically important materials is more often than not, a complex arrangement of crystalline defects and stable or metastable phases producing both desirable and/or detrimental alloy properties. During the last decade, transmission electron microscopy (TEM) has allowed the materials scientist to explore the morphology and crystallography of these structures in reasonable detail. However, in complex materials imaging and diffraction experiments are not always sufficient to identify all observed phases uniquely. Elemental segregation to defect sinks during thermal ageing or irradiation can result in substantial modification to local alloy composition and requires specialized techniques for determination of local compositions at high spatial resolutions. Analytical electron microscopy (AEM) is the term now used to describe a group of electron-column based techniques which, when used in conjunction with a modern transmission or scanning transmission electron microscope (TEM/STEM), and can provide quantitative morphological, crystallographic and elemental analysis from areas of a material as small as 20 nm in diameter. The basic principles of elemental microanalysis in an analytical electron microscope will be discussed together with examples of its application to materials science investigations.

41136 **Grain boundary chemistry, fracture mode and ductility comparisons for iron and nickel tested at cathodic potentials.** Jones, R.H.; Bruemmer, S.M.; Thomas, M.T.; Baer, D.R. (Pacific Northwest Lab., Richland, WA). pp 369-376 of Hydrogen effects in metals. Bernstein, I.M.; Thompson, A.W. New York, NY; American Institute of Mechanical Engineers (1980). Contract AC06-76RL01830.

From 3. international conference on effect of hydrogen on behavior of materials; Moran, WY, USA (26 Aug 1980).

Iron and nickel containing similar grain boundary sulfur concentrations show similar changes in fracture mode and ductility at equivalent cathodic potentials. Both iron and nickel show a change from microvoid coalescence to intergranular fracture at grain boundary sulfur concentrations of about 0.1 monolayers accompanied by a decrease in the total elongation and reduction of area. It is not unexpected that sulfur at the grain boundaries of iron and nickel promotes intergranular fracture in both materials at cathodic potentials as others (1 to 6) have shown that grain boundary impurities enhance the intergranular fracture of iron and nickel and their

alloys. The similarity of the effect of sulfur in iron and nickel is unusual and it is this aspect which this paper addresses.

41137 **Defect structures in neutron-irradiated iron.** Bentley, J. (Oak Ridge National Lab., TN); Horton, L.L.; Farrell, K. pp 390-391 of Thirty-eighth annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). New York, NY; Electron Microscopy Society of America (1980). Contract W-7405-ENG-26.

From 38. annual proceedings of the Electron Microscopy Society of America; San Francisco, CA, USA (1980).

Iron samples neutron irradiated at temperatures from 182 to 500°C to ~ 1 dpa and at 650 to 740°C to ~ 0.5 dpa were studied by TEM techniques. The observed evidence of the dislocation component of the various microstructures is illustrated. A low point defect retention in clusters compared to other bbc and fcc metals of similar purity was found. This is thought to be due in part to the dominant role that carbon plays in the behavior of α-iron through segregation at defect clusters and through trapping of point defects. (BLM)

41138 **Phase identification in neutron irradiated stainless steels.** Lee, E.H.; Rowcliffe, A.F. (Oak Ridge National Lab., TN). pp 382-383 of Thirty-eighth annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). New York, NY; Electron Microscopy Society of America (1980). Contract W-7405-ENG-26.

From 38. annual proceedings of the Electron Microscopy Society of America; San Francisco, CA, USA (1980).

Techniques used for the identification of phases which develop in AISI 316 stainless steel which has been modified by the addition of Ti are described. Five major phases were identified in the alloy containing 0.2 wt % Ti after irradation by 7 x 10^{22} n.cm^{-2} at temperatures ranging from 400 to 650°C. Once identification was established from diffraction pattern measurements, subsequent identification could be made by observation of the characteristic shape of each phase combined with the observation of certain characteristic features of te x-ray spectrum of each phase. This combination permitted rapid identification of large numbers of particles necessary for the elucidation of the role of phase instabilities in void swelling. (BLM)

41139 **Optical properties of metals by spectroscopic ellipsometry.** Arakawa, E.T.; Inagaki, T.; Williams, M.W. (Oak Ridge National Lab., TN). *Surface Science;* **96**: 248-274(1980). Contract W-7405-ENG-26.

The use of spectroscopic ellipsometry for the accurate determination of the optical properties of liquid and solid metals is discussed and illustrated with previously published data for Li and Na. New data on liquid Sn and Hg from 0.6 to 3.7 eV are presented. Liquid Sn is Drudelike. The optical properties of Hg deviate from the Drude expressions, but simultaneous measurements of reflectance and ellipsometric parameters yield consistent results with no evidence for vectorial surface effects. 51 references, 17 figures.

41140 **Limitations in specular beam leed analysis due to measurement of the scattering angle: examples from a study of Cu(110).** Noonan, J.R.; Davis, H.L. (Oak Ridge National Lab., TN). *Surface Science;* **99**: L424-L428(1980). Contract W-7405-ENG-26.

The I-V profiles for specular LEED beams from a clean Cu(110) surface have been measured for three selected angles of incidence of the primary electron beam with respect to the crystal orientation. A comparison of experimental and calculated profiles indicates that the first interlayer spacing is contracted by 8 +- 3%, a value in reasonable agreement with the result obtained by a previous study of non-specular beams. However, this study demonstrates some inherent limitations of LEED analyses due to difficulties in the precise measurement of the alignment of the primary electron beam. 5 references, 1 figure.

41141 **(PNR—20039) Coating + grinding = protection against wear.** Bormann, M. Translated from *Oberflaeche + JOT ;* **3**: vp(1979). 9p. (In several languages). NTIS, PC A02/MF A01.

The evolution of the use of thermally sprayed coatings for imparting wear resistance to metal parts is presented. Alloys of chromium, nickel, boron and 13% tungsten are melted on with oxyacetylene torches. Small pieces are heated with a torch larger ones are preheated in a furnace. Diamond wheels were used in place of boron nitride tools for finishing the sprayed pieces. Grinding wheels of metal coated synthetic diamonds in a synthetic resin binder are the most successful. (ESA)

41142 **Estimates of time-dependent fatigue behavior of type 316 stainless steel subject to irradiation damage in fast breeder and fusion power reactor systems.** Brinkman, C.R.; Liu, K.C.; Grossbeck, M.L. (Oak Ridge National Lab., TN). pp 490-510 of Special technical publication 683. Philadelphia, PA; American Society for Testing and Materials (1979). Contract W-7405-ENG-26.

Cyclic lives obtained from strain-controlled fatigue tests at 593°C of specimens irraidated in the experimental breeder reactor II (EBR-II) to a fluence of 1 to 2.63 x 10^{26} neutrons (n)/m^2 E > 0.1 MeV) were compared with predictions based on the method of strain-range partitioning. It was demonstrated that, when appropriate tensile and creep-rupture ductilities were employed, reasonably good estimates of the influence of hold periods and irradiation damage on the fully reversed fatigue life of Type 316 stainless steel could be made. After applicability of this method was demonstrated, ductility values for 20% cold-worked Type 316 stainless steel specimens irradiated in a mixed-spectrum fission reactor were used to estimate fusion reactor first-wall lifetime. The ductility values used were from irradations that simulate the environment of the first wall of a fusion reactor. Neutron wall loadins ranging from 2 to 5 MW/m^2 were used. Results, although conjectural because of the many assumptions, tended to show that 20% cold-worked Type 316 stainless steel could be used as a first-wall material meeting a 7.5 go 8.5 MW-year/m^2 lifetime goal provided the neutron wall loading does not exceed more than about 2 MW/m^2. These results were obtained for an air environment, ant it is expected that the actual vacuum environment will extend lifetime beyond 10 MW-year/m^2.

41143 **Kinetic aspects of slow crack growth in the gaseous hydrogen embrittlement of steels.** Sieradzki, K. (Iowa State Univ., Ames); Ficalora, P. *Journal of Materials Science;* **14**: 2703-2708(1979).

An explanation of the slow crack-growth phenomenon in gaseous hydrogen embrittlement is suggested on the basis that chemisorption is the rate-limiting step. The basis of the analysis is the existence of a mobile absorbed species which is a prerequisite to the occurrence of slow crack growth. The disappearance of the mobile species with increasing temperature results in the observed crack-velocity dependence on temperature. The analysis is able to account qualitatively for the observed dependence of crack velocity with pressure in the different temperature regions of crack growth.

41144 **Impression creep of β-tin single crystals.** Chu, S.N.G.; Li, J.C.M. (Univ. of Rochester, NY). *Materials Science and Engineering;* **39**: 1-10(1979). Contract EY-76-S-02-2296.

The impression creep of β-tin single crystals was studied in three orientations: [001], [100] and [110]. The temperature dependence of the steady state impression velocity showed two parallel processes. The activation enthalpy for the high temperature process was 25 to 26 kcal mol^{-1} for all three orientations and showed no obvious effects of stress. The value is comparable to that for self-diffusion, 25.6 kcal mol^{-1}. For the low temperature process, the activation enthalpy was stress dependent. Some values are 8.2 kcal mol^{-1} for the [001] orientation at 16 to 20 MN m^{-2}, 10 kcal mol l^{-1} for [100] at 12 to 16 MN m^{-2}, and 9.4 kcal mol^{-1} for [110] at 16 to 20 MN m^{-2}. For all orientations and all temperatures, the stress dependence of the impression velocity obeyed a power law with stress exponents between 3.6 and 5.0, in general agreement with previously reported results from conventional creep tests. Slip lines developed around the impression were more numerous at low temperatures than at high temperatures. Pencil slip was observed at low temperatures but not at high temperatures in the [001] orientation. It is suggested that the low temperature process involves dislocation slip and the high temperature process involves dislocation climb.

41145 **Stress corrosion cracking test with slow strain rate and constant current.** Ondrejcin, R.S. (Savannah River Lab., Aiken, SC). pp 203-221 of Stress corrosion cracking: the slow strain-rate technique. Special Technical Publication 665. Ugiansky, G.M.; Payer, J.H. (eds.). Philadelphia, PA; American Society for Testing and Materials (1979).

A rapid electrochemical tension test was developed for evaluating stress corrosion crack initiation in carbon steel. Constant anodic current was imposed on smooth-bar tension specimens as the specimens were slowly strained to fracture at 1.3 x 10^{-6}/s. Equivalent results were obtained for the following ductility properties measured: uniform elongation, total elongation, and reduction of area. Total elongation was chosen as the index for stress corrosion crack initiation. An equation was developed that allowed calculation of total elongation of specimens in electrolytes (test solutions) with composition ranges of 1.5 to 5.5 M nitrate, 0 to 3.5 M nitrite, and 0 to 5.0 M hydroxide, and a temperature range of 50 to 100°C. A minimum of 13% total elongation was selected to indicate the possible initiation of cracking in A 285-B steel alloy. The test was used to evaluate relative aggressiveness of synthetic nuclear wastes on A 285-B carbon steel and the relative resistances of several steels to given solution compositions. Test results formed one of the bases for setting temperature and concentration limits for several ions in nuclear wastes that are stored in carbon steel tanks at the Savannah River Plant.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 40090, 40091, 40092, 40094, 40095, 40096, 40097, 40269, 40292, 40918, 41278, 41283

41146 (CONF-811061—, pp VI.11-VI.19) **Creep and related properties of refractories.** Tighe, N.J.; McDaniel, C.L. (National Bureau of Standards, Washington, DC). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Based on the accomplishments during the first two years of our program, it is clear that the acquisition of static fatigue or creep data under constant and cyclic temperature conditions provides important information on behavior of refractories for high-temperature, structural applications. The reduced cross-section creep specimen has provided valid, reproducible engineering data on a variety of refractory materials. During the program we have developed a microstructural analysis capability that can be exploited to provide mechanistic information on high temperature deformation of refractories. With the completion of the test facility we can obtain data over long time intervals. During the long-term exposures greater emphasis can be placed on correlating the microstructural changes with the creep mechanisms.

41147 **(MLM—2904(OP)) Jahn-Teller resonance states in the Vb metal hydrides.** Abell, G.C. (Mound Facility, Miamisburg, OH (USA)). 1982. Contract AC04-76DP00053. 5p. (CONF-820325—3). NTIS, PC A02/MF A01. Order Number DE82008462.

From International symposium on the electronic structure and properties of hydrogen in metals; Richmond, VA, USA (4 Mar 1982).

A hamiltonian with a localized Jahn-Teller electron-phonon interaction plus a band-coupling term belonging to a metal cluster state adjacent to interstitial hydrogen in the Vb metals is presented. It is shown that in a low-frequency approximation, this hamiltonian is analogous to the Anderson Hamiltonian for magnetic impurities in metals. The role of hydrogen in triggering the Jahn-Teller instability is explained in the context of the Hartree-Fock solutions of the low-frequency hamiltonain, using a phase diagram in the Hartree-Fock parameter space. An elastic susceptibility expression is derived and compared with an observed elastic relaxation. The empirical connection of the Jahn-Teller distortion to the observed elastic dipole tensor is reconsidered.

41148 **(MLM—2905(OP)) Proton NMR studies of the electronic structure of ZrH/sub x/.** Attalla, A.; Bowman, R.C. Jr.; Craft, B.D.; Venturini, E.L.; Rhim, W.K. (Monsanto Research Corp., Miamisburg, OH (USA)). 1982. Contract AC04-76DP00053. 6p. (CONF-820325—2). NTIS, PC A02/MF A01. Order Number DE82008461.

From International symposium on the electronic structure and properties of hydrogen in metals; Richmond, VA, USA (4 Mar 1982).

The proton spin-lattice relaxation times and Knight shifts have been measured in f.c.c. (δ-phase) and f.c.t. (ε-phase) ZrH/sub x/ for $1.5 \leqq x \leqq 2.0$. Both parameters indicate that N(E/sub F/) is very dependent upon hydrogen content with a maximum occurring at $ZrH_{1.83}$. This behavior is ascribed to modifications in N(E/sub F/) through a fcc/fct distortion in ZrH/sub x/ associated with a Jahn-Teller effect.

41149 **(MLM—2906(OP)) Hydrogen diffusion and electronic structure in crystalline and amorphous Ti/sub y/CuH/sub x/.** Bowman, R.C. Jr.; Rhim, W.K.; Maeland, A.J.; Lynch, J.F. (Monsanto Research Corp., Miamisburg, OH (USA); California Inst. of Tech., Pasadena (USA); Allied Chemical Corp., Morristown, NJ (USA). Materials Research Center; Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC04-76DP00053. 6p. (CONF-820325—4). NTIS, PC A02/MF A01. Order Number DE82008460.

From International symposium on the electronic structure and properties of hydrogen in metals; Richmond, VA, USA (4 Mar 1982).

Hydrogen diffusion behavior and electronic properties of crystalline $TiCuH_{0.94}$, $Ti_2CuH_{1.90}$, and $Ti_3CuH_{2.63}$ and amorphous a-$TiCuH_{1.4}$ are studied using proton relaxation times, proton Knight shifts, and magnetic susceptibilities. Crystal structure and hydrogen site occupancy have major roles in hydrogen mobility. The density of electron states at E/sub F/ is reduced in amorphous a-$TiCuH_{1.4}$ compared to the crystalline hydrides.

41150 **(PB—81-202012) Ceramic fiber insulated furnances state-of-the-art. Final report.** Powell, D.; Lakshmanan, T. (Cameron Iron Works, Inc., Houston, TX (USA)). Oct 1980. 178p. NTIS, PC A09/MF A01.

The investigation covered the use of mainly alumina-silica (ceramic) fibers as applied in high temperature industrial environments. The main emphasis is on the four major manufacturing groups: petrochemical; stone, clay and glass; ferrous and non-ferrous metals; and the fabricated metal product industries.

41151 **(SAND—82-0168C) Octahedral site occupation in lanthanum dihydride.** Venturini, E.L. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 6p. (CONF-820325—1). NTIS, PC A02/MF A01. Order Number DE82008467.

From International symposium on the electronic structure and properties of hydrogen in metals; Richmond, VA, USA (4 Mar 1982).

The distribution of hydrogen ions among the octahedral and tetrahedral sites in lanthanum hydride has been determined at liquid helium temperatures for hydrogen/metal ratios from 1.90 to 2.04. Electron spin resonance spectra of dilute erbium ions substituted for host metal atoms establish the hydrogen site occupation adjacent to the erbium versus hydrogen loading. These data together with a lattice-gas calculation yield the site occupation versus hydrogen concentration in bulk lanthanum hydride, which is such that 2% of the octahedral sites are filled in $LaH_{2.00}$.

41152 **Hyperfine magnetic field measurements in $ErRh_4B_4$.** Cort, G.; Taylor, R.D.; Willis, J.O. (Los Alamos National Lab., NM (USA)). *Physica B+C (Amsterdam);* **108**: No. 1-3, 809-810(Aug-Sep 1981).

From 16. international conference on low temperature physics; Los Angeles, CA, USA (19 - 25 Aug 1981).

We report measurements of the hyperfine magnetic field in $ErRh_4B_4$ in zero applied field in a range of temperatures around the reentrant temperature Tsub(cl). Using the Moessbauer effect of

^{57}Fe impurities as a hyperfine field microprobe, we find that the low temperature ferromagnetic order persists well above Tsub(cl) into the superconducting state in this compound, thereby providing direct evidence of coexistence between superconductivity and magnetic order.

41153 **Specific heat studies of $V_3GaHsub(x)$.** Cort, B.; Stewart, G.R. (Los Alamos National Lab., NM (USA)); Huang, S.Z.; Meng, R.L.; Chu, C.W. (Houston Univ., TX (USA). Dept. of Physics). *Physica B+C (Amsterdam);* **108**: No. 1-3, 923-924(Aug-Sep 1981).

From 16. international conference on low temperature physics; Los Angeles, CA, USA (19 - 25 Aug 1981).

The specific heat of $V_3GaHsub(x)$ has been measured for hydrogen concentrations x = 0, 0.2, 1.4, and 1.9 over the temperature range 1.2-20 K. Effects of hydrogenation include increased lattice parameter, depressed transition temperature, enhanced Debye temperature, and markedly reduced density of states. In addition, decreased electron-phonon coupling is indicated.

3603 Composite Materials

41154 **(DOE/ET/29044—1) Development of a high conductivity intercalated graphite composite wire.** Singhal, S.C. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). Feb 1982. Contract AC01-79ET29044. 147p. NTIS, PC A07/MF A01. Order Number DE82008973.

Beginning in May 1979, the Department of Energy initiated the present program entitled, Development of a High Conductivity Intercalated Graphite Composite Wire, to develop the scientific base and technology for reproducibly fabricating high conductivity intercalated graphite composite wires. Toward achieving this objective, the following work was carried out in this program: (1) composite wires previously fabricated by swaging at the University of Pennsylvania and claimed to possess conductivity equal to or greater than that of copper were analyzed, (2) intercalation of HOPG crystals with SbF_5+HF mixtures was studied to assess the effect of defects in the starting graphite on the final conductivity and also to determine the conductivity as a function of the stage of the compound, and (3) composite wires consisting of copper, aluminum or lead outer sheath and SbF_5+HF- or AsF_5-intercalated graphite in the core were fabricated by swaging and/or drawing and then analyzed for their electrical conductivity.

41155 **(SAND—81-1202C) Transverse compressive stress-strain behavior of thick Kevlar/epoxy laminates.** Guess, T.R.; Ericksen, R.H. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 28p. (CONF-820340—1). NTIS, PC A03/MF A01. Order Number DE82008194.

From Symposium on compression testing of homogenous materials and composites; Williamsburg, VA, USA (10 Mar 1982).

The room-temperature compressive stress-strain response of quasi-isotropic Kevlar 49 fabric/epoxy composites was studied. Cylindrical specimens with porosity up to 20% were loaded normal to the plane of fiber reinforcement. Sample porosity was an important factor affecting the shape of the compressive stress-strain curve, modulus, strength, strain to failure, and Poisson's ratio. As a porous specimen was loaded in compression the tangent modulus first decreased due to void collapse, and then increased as complete consolidation was approached. Increasing the porosity from 1 to 20% caused: (a) the initial modulus to decrease from 6.0 to 1.4 GN/m^2; (b) the strength to reduce from 1150 to 580 MN/m^2; (c) Poisson's ratio to change from 0.15 to 0.06; and (d) the failure strain to increase from 16 to 26%. Most of the axially compressed cylindrical specimens failed along inclined planes by shearing through many layers of fabric. Broken fibers were observed on the fracture surfaces.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 41155

41156 **(PB—82-854530) Electrically conductive plastics. January, 1976-October, 1981 (citations from the energy data base). Report for Jan 76-Oct 81.** (National Technical Information Service, Springfield, VA (USA)). Oct 1981. 104p. NTIS PC N01/MF N01.

This bibliography cites reports on the preparation, properties, and behavior of electrically conductive polymers. Applications include solar cells. (This updated bibliography contains 91 citations, 30 of which are new entries to the previous edition.)

3606 Other Materials

REFER ALSO TO CITATION(S) 40278, 40280, 40287, 40287, 40292, 40309, 40309, 40406, 40407, 40408, 40409, 40411

41157 **(AD-A—098113/4) Basic problems in InP technology. Final report, 16 November 1979-15 November 1980.** Vaidyanathan, K.V.; Dunlap, H.L.; Jullens, R.A.; Anderson, C.L. (Hughes Research Labs., Malibu, CA (USA)). Mar 1981. 51p. NTIS PC A04/MF A01.

The growth and characteristics of high-purity epitaxial InP layers grown by liquid phase epitaxy are described. Silicon and sulfur will be the dominant residual donors in LPE-grown InP. Techniques to reduce the residual donor concentration in the LPE layers are discussed. Chemical polishing the mesa etching of InP and ohmic contact studies to n- and p-type InP are discussed. Preliminary investigations show that at power densities of 50,000 W per sq. cm., permanent laser-induced surface damage occurs in InP. Thus laser-annealed ohmic contacts need to be formed at power densities 50,000 W per sq. cm. Severe surface degradation was observed in SiO_2 encapsulated, ion-implanted InP samples annealed at 700 C. The use of phosphorus-doped glass (PSG) dramatically reduces such surface degradation. The glass (PSG) dramatically reduces such surface degradation. The electrical properties of Be and Si-implanted layers are reported as functions of both implantation dose and anneal temperature. Preliminary secondary ion mass spectrometry (SIMS) studies show that at high concentrations dramatic redistribution effects occur in Be-implanted and annealed InP, while no significant diffusion occurs in Si-implanted and annealed InP.

41158 **(AD-A—098217/3) Time-resolved optical transmission of pulsed laser-irradiated silicon.** Lee, M.C.; Lo, H.W.; Aydinli, A.; Compaan, A. (Kansas State Univ., Manhattan (USA). Dept. of Physics). 20 Oct 1980. 12p. NTIS PC A02/MF A01.

The time-resolved optical transmission of silicon has been observed at lambda = 1.15 microns during irradiation by an 8 nsec pulsed laser at 485 nm with several energy densities in the range of .25 to 1.2 J/sq cm. The transmission exhibits a sudden brief drop consistent with the rise and fall of the reflectivity enhancement. However, the transmission does not exhibit the strong absorption expected of molten silicon with a skin depth of approx. 100A.

41159 **(DOE/ER/10877—T1) Time-resolved far-infrared spectroscopy of excitons. Progress report, July 15, 1981-January 15, 1982.** Nurmikko, A.V.; Glicksman, M. (Brown Univ., Providence, RI (USA). Dept. of Engineering). Jan 1982. Contract AC02-81ER10877. 8p. NTIS, PC A02/MF A01. Order Number DE82008787.

In this progress review we show results of initial work, performed to measure and characterize the low-density excitonic phase of nonequilibrium optically excited gallium phosphide. Specifically, the infrared spectra of laser excited gallium phosphide has been measured as a function of temperature. The infrared spectrum contains contributions from intervalence band transitions by the photoexcited holes. We have shown that holes which are strongly Coulomb correlated with electrons show broad intervalence band absorption spectra unlike that expected for free holes at low temperatures.

41160 **(ENPU—80-12) Geochemical factors controlling the nuclide release source-term in granite: dissolution of the waste form.** Savage, D.; Chapman, N.A. (Institute of Geological Sciences, Harwell (UK). Environmental Protection Unit). Jul 1980. 30p. Environmental Protection Unit, Institure of Geological Sciences, Building 151, Harwell Laboratory, Oxfordshire OX11 ORA, England.

Portions of document are illegible.

This study was designed to provide information on the behavior of the glass waste form at realistic repository conditions of temperature, pressure, and fluid content. Particular attention has been paid to the mechanisms of glass corrosion and the nature of the products of glass dissolution. Alkali dissolution from glasses 189 and 209 at 100°C and 150°C is controlled by diffusion through a surface alteration layer. This means that the rate at which alkalis are dissolved from the glass decreases with time and it would appear that the surface layer is protective against dissolution. Dissolution is temperature dependent, increasing two orders of magnitude for glass 209 between 100°C and 350°C. Increasing total pressure from 60 MPa to 100 MPa increased dissolution by a factor of two at 150°C, but had little effect at 250°C. SEM and XRD examination of the surface layer on the glasses indicates that at temperatures of 100°C and 150°C this layer is amorphous with trace amounts of crystalling kaolinite. At temperatures of 200°C and above this surface layer is covered with a Na-Cs-Zr smectite mineral, and at 350°C a sodic feldspar is also present. (DMC)

41161 **(PB—81-861056) Physical properties of cadmium arsenide. January, 1966-May, 1981 (citations from the Metals Abstracts Data Base). Report for January 1966-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 59p. NTIS PC N01/MF N01.

The properties of cadmium arsenide are discussed in terms of the preparation of semiconductor devices. Emphasis is placed on the optical properties of cadmium arsenide as well as the piezoelectric effect for pressure measurements. Magnetic and transport properties are also discussed. (Contains 88 citations fully indexed and including a title list.)

41162 **Total and net displacement functions for polyatomic materials.** Parkin, D.M. (Los Alamos National Lab., NM (USA)); Coulter, C.A. (Alabama Univ., University (USA). Dept. of Physics). *Journal of Nuclear Materials;* **101**: No. 3, 261-276(Oct 1981).

Using a continuous-slowing-down, random amorphous material model in which displacement and recombination processes are determined by sharp displacement thresholds and capture energies, we have studied displacement cascades in a number of diatomic materials and a few triatomic materials. The results obtained are presented here in terms of a set of displacement efficiencies for each material which correlate the calculated number of net displacements with the damage energies, displacement thresholds, and stoichiometry of the material. Materials for which the ratio of heavy to light mass is less than about four (Type 1) show somewhat different displacement cascade characteristics than those for which the mass ratio is greater than four (Type 2). In addition, for each material the dependence of the cascades on the energy of the primary has different properties in two different energy ranges. In Region I, extending from the lowest displacement threshold to about 1 keV for Type-1 materials and to about 100 keV for Type-2 materials, the displacement efficiencies show strong dependence on energy and on the atom type of the primary. In Region 2 (energies higher than Region 1) the displacement efficiencies are nearly independent of energy and of the type of the primary. Cascades in Type-1 materials can show strong dependence on the capture probability for atoms on sites of unlike type; thisdependence is discussed, as is the dependence of cascade structure on displacement threeshold. Rather strong nonstoichiometric behavior is demonstrated for certain Type-2 materials. Comparisons are made with a few previous calculations for diatomic materials.

41163 **Modeling of irradiation-induced homogeneous precipitation in proton-bombarded Ni-Si solid solutions.** Lam, N.Q. (Argonne National Lab., IL (USA). Materials Science Div.); Janghorban, K.; Ardell, A.J. (California Univ., Los Angeles (USA). Dept. of Engineering; California Univ., Los Angeles (USA). Dept. of Materials). *Journal of Nuclear Materials;* **101**: No. 3, 314-325(Oct 1981).

Irradiation-induced solute redistribution leading to precipitation of coherent γ' particles in undersaturated Ni-based solid solutions containing 6 and 8 at.% Si during 400-keV proton bombardment was modeled, based on the concept of solute segregation in concentrated alloys under spatially-dependent defect production conditions. The combined effects of (i) an extremely large difference between the defect production rates in the peak-damage and mid-range regions during irradiation and (ii) a preferential coupling between the interstitial and solute fluxes generate a net transient flux of Si atoms into the mid-range region, which is much larger than the solute flux out of this location. As a result, the Si concentration exceeds the solubility limit and homogeneous precipitation of the γ' phase occurs in this particular region of the irradiated samples. The spatial, compositional and temperature dependences of irradiation-induced homogeneous precipitation derived from the present theoretical calculations are in good qualitative agreement with experimental observations.

41164 **Conduction plane and structure of Li-stabilized Na^+ β''-alumina: a powder neutron diffraction study.** Jorgensen, J.D.; Rotella, F.J. (Argonne National Lab., IL (USA)); Roth, W.L. (General Electric Co., Schenectady, NY (USA). Research and Development Center). *Solid State Ionics;* **5**: 143-146(Oct 1981).

From International conference on fast ionic transport in solids; Gatlinburg, TN, USA (18 - 22 May 1981).

The structure of Li-stabilized Na^+ β''-alumina has been refined by Rietveld analysis of high resolution time-of-flight powder diffraction data. The sample was a sintered tube of the type used for battery separators. The Li was found to reside in the Al(2) site in the spinel block. Fourier mapping and Rietveld analysis revealed that Na is located in both 6c and 18h sites separated 1.03(3) A in the conduction slab.

41165 **Structures of four fast-ion conductors by single-crystal neutron diffraction analysis: Zn-stabilized Naβ''-alumina and Mg-stabilized Na-, K-, and Agβ''-aluminas.** Brown, G.M.; Schwinn, D.A.; Bates, J.B.; Brundage, W.E. (Oak Ridge National Lab., TN (USA)). *Solid State Ionics;* **5**: 147-150(Oct 1981).

From International conference on fast ionic transport in solids; Gatlinburg, TN, USA (18 - 22 May 1981).

The crystal samples used were from the same batches as those used in other physical studies at Oak Ridge. Precise cell parameters were determined. The Zn^{2+} ion substitutes only in the Al(2) sites, as does Mg^{2+}. The degree of substitution by Zn^{2+} (28.5% from chemical analysis and 29.3% from diffraction analysis) is less than that by Mg^{2+} (33.5% from chemical analysis and 34.9% for the average diffraction result from the three Mg-stabilized β''-aluminas). This implies more Na^+ vacancies in Zn-stabilized Naβ''-alumina and may explain why it has a higher room temperature conductivity than Mg-stabilized β''-alumina. Fourier maps of the conducting-ion distributions are presented. The O(5) ions were treated as disordered in refinement of Mg-stabilized Ag- and Naβ''-aluminas.

41166 **(NASA-TM—75880) Hot isostatic pressing of silicon nitride Si_3N_4 containing zircon, or zirconia and silica.** Somiya, S.; Yoshimura, M.; Suzuki, T.; Nishimura, H. Translated from *Taikabutsu ;* 258, 332-339(Dec 1980). 16p. NTIS, PC A02/MF A01.

A hydrothermal synthesis apparatus with a 10 KB cylinder was used to obtain a sintered body of silicon nitride. The sintering auxiliary agents used were zircon (ZrSiO4) and a mixture of zirconia (ZrO2) and silica (SiO2). Experiments were conducted with the amounts of ZrSi04 or ArO2 and SiO2 varying over a wide range and the results compared to discover the quantity of additive

which produced sintering in silicon nitride by the hot pressing method.

40 CHEMISTRY

REFER ALSO TO CITATION(S) 41974

41167 (LBL—12534) Computational trends in theoretical chemistry. Lester, W.A. Jr.; Dupuis, M.; O'Donnell, T.J.; Olson, A.J. (Lawrence Berkeley Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 9p. (CONF-810847—3). NTIS, PC A02/MF A01. Order Number DE82011034.

From 28. international union of pure and applied chemistry symposium; Vancouver, British Columiba, Canada (Aug 1981).

That aspect of the National Resource for Computation in Chemistry's (NRCC) mission directed to advancing the capability of chemists to use computers has led to involvement in efforts to facilitate computations by theoretical chemists. The areas of greatest concentration include algorithm selection and software implementation. Experiences at the NRCC and their implications for the fields of collision dynamics, crystallography, graphics, macromolecular science, quantum chemistry, and statistical mechanics are briefly summarized. A recent study of the reaction of O with C_2H_4 is discussed to provide an illustration of progress in the understanding of reaction pathways using computational methods.

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 40137, 40138, 40142, 40143, 40144, 40195, 40244, 40261, 40335, 41201, 41206, 41358, 41422, 41485, 41547, 41667

41168 (BARC—1088) X-ray fluorescence analysis of erbium oxide/oxalate for rare earth impurities. Chandola, L.C.; Khanna, P.P.; Thomas, A. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700802.

A method for the determination of Tb, Dy, Ho, Tm, Yb, Lu and Y oxides in Er_2O_3 is described. 450 mg sample in the oxalate form is mixed with 150 mg boric acid binding material and pressed into a 1.25 inch diameter pellet over a supporting pellet of boric acid. The sample is then irradiated by X-rays from a tungsten tube and the fluorescent X-rays are dispersed by a LiF (200) crystal in a Philips PW 1220 semiautomatic X-ray fluorescence spectrometer. The intensities of characteristic X-rays of the impurity elements are measured by a flow proportional counter for all elements except yttrium for which the intensities are measured by a scintillation counter. The lowest determination limit is 0.005% for all impurities except for Yb for which it is 0.01%. Calculations for theoretical detection limit are given.

41169 (BARC—1094) Extractive spectrophotometric determination of thorium. Venkatesan, M.; Gopalakrishnan, V.; Ramanujam, A.; Nadkarni, M.N. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700803.

An extractive spectrophotometric method has been standardized for the analysis of 0.2 to 1.6 milligrams of thorium present in nitric acid solutions. The method involves the extraction of thorium from nitric acid solutions into 0.5 M thenoyl trifluoro acetone (HTTA) in benzene and its direct estimation from the organic extract by spectrophotometry as Thoron colour complex. In this method, interference due to iron upto 5 milligrams can be suppressed by adding ascorbic acid in the ratio of 1:2 prior to HTTA extraction. Uranium(VI) does not interefere even when present in 2000 times the amount of thorium. Plutonium and cerium do not interfere at one milligram level whereas zirconium interferes in this method. The overall error variation and precision of this method has been determined to be +- 3.5%.

41170 (BARC—1107) Direct spectrographic determination of major amounts of some rare earths and thorium in allanite. Bellary, V.P.; Ghodgaonkar, G.S.; Sankaran, A.V. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700804.

A d.c. arc spectrographic method for direct estimation of Ce, Eu, Gd, La, Th and Y quantitatively and Nd and Sm semiquantitatively in allanite, a complex rare-earth silicate mineral, is described. Using 3.4 m. Jarrell-Ash grating spectrograph, spectra of synthetic standards and samples mixed with specpure graphite-internal standard mixture in 1:5 ratio, are photographed on Kodak SA-1 emulsion from 2720 A to 3330 A. Pd is used as an internal standard. The determination range of most of the elements cover the range of their natural abundance in allanites. The average standard deviation of the method is +- 15%. The analysis results of one natural allanite sample by the present method are compared with those obtained by XRF method.

41171 (CNEA—450) Determination of cadmium in aluminium by atomic absorption spectrometry. Batistoni, D.A.; Erlijman, L.H. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Dec 1978. 12p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701032.

A direct method for the determination of cadmium in elemental aluminium is described. Metal samples are dissolved in diluted hydrochloric acid and cadmium is determined by atomic absorption spectrometry in an air-acetylene flame. Interference by nonspecific absorption observed at the analytical wavelength incorrected for by means of a non-absorbing line emitted by the hollow-cathode lamp. Relatively large amounts of arsenic do not interfere. The minimum determinable concentration of cadmium for this procedure is 2-3 ppm, expressed on aluminium basis.

41172 (DOE/PC/40809—T2) Separation of asphaltenes using high-resolution supercritical fluid chromatography. Progress report, December 1, 1981-February 28, 1982. Jackson, W.P.; Peaden, P.A.; Fjeldsted, J.C.; Lee, M.L. (Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry). 1982. Contract FG22-81PC40809. 18p. NTIS, PC A02/MF A01. Order Number DE82008469.

During this period pressure programming techniques for the capillary supercritical fluid chromatograph (SFC) were examined and applied to the analysis of polystyrene oligomer samples as well as polycyclic aromatic hydrocarbon (PAH) extracts from a carbon black sample. Cross-linking procedures for insoluble non-polar stationary phases were evaluated to determine relative merits of various cross-linking agents and techniques. The second SFC instrument was constructed and interfaced to a microcomputer for control of the UV detector as well as for control of pressure programming.

41173 (DP—1608) Analysis procedure for americium in environmental samples. Holloway, R.W.; Hayes, D.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jan 1982. Contract AC09-76SR00001. 14p. NTIS, PC A02/MF A01. Order Number DE82009270.

Several methods for the analysis of ^{241}Am in environmental samples were evaluated and a preferred method was selected. This method was modified and used to determine the ^{241}Am content in sediments, biota, and water. The advantages and limitations of the method are discussed. The method is also suitable for ^{244}Cm analysis.

41174 (EIR—363) Separation of the rare earths by high pressure liquid chromatography and the fission yield on sup(148m)Pm and sup(148g)Pm using thermal neutron induced fission of ^{233}U and ^{239}Pu. Zwicky, H.U. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Mar 1979. 121p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82700805.

This report is in two parts: in the first part, the method of high pressure liquid chromatography is described with particular reference to rare earth nuclei produced in nuclear reactions; in the second part, the results of a study of the fission yield of sup(148m)Pm and sup(148g)Pm from the thermal fission of ^{233}U and ^{239}Pu are presented.

41175 **(EIR—389) Comparison between alpha autoradiography and some measured alpha emitting actinides in a (U,Pu)C sphere-pac fuel.** Flueckiger, U. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Apr 1980. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700806.

Autoradiographs of non-irradiated and irradiated (UPu)C sphere-pac fuel were taken under various conditions and compared with the radial plutonium concentration profile and with the radial behaviour of the alpha spectrum. The results show clearly that alpha autoradiographs reproduce only the distribution of plutonium in non irradiated nuclear fuel. In irradiated fuel, the alpha autoradiographs correspond to a superimposition of various alpha emitters and are especially influenced by the isotope Curium-242 at cooling times less than 3 years.

41176 **(EUR—7166-IT) Determination of water in iron chlorides critical examinations of various methods.** Serrini, G.; Serrini-Lanza, G. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 15p. (In Italian). Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The determination of water in various types of iron chlorides or mixtures of these chlorides with various iron chlorides using Karl Fischer titration is reported. In the case of direction titration, Fe (III) interferes with the Karl Fischer reagent. A preliminary separation of the water by azeotropic distillation (water-chloroform) allows the determination of water without any interferences. This separation method can be applied to other products for which the determination of water by direct Karl Fischer titration is not applicable.

41177 **(EUR—7352-EN) Certification of the elemental composition of the BCR reference materials No. 71, containing carbon, hydrogen, bromine, chlorine, nitrogen, oxygen and sulphur, and No. 73, containing carbon, hydrogen, bromine, chlorine, fluorine and nitrogen.** Griepink, B.; Hamers, L.; le Duigou, Y. (Rijksuniversiteit Utrecht (Netherlands); Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 41p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

This report describes the procedure followed to characterize two lots of materials containing halogens, which are intended to serve as reference materials (RM) for organic elemental analysis. To be satisfactory, a reference material whether it consists of a single compound or a mixture of compounds, should not change its elemental composition over many years. It should be resistant to atmospheric conditions with regard to light, oxygen, heat and humidity and be readily analysable for all its major elements. Certification of the C, H, Br, Cl, N, O and S contents in the Community Bureau of Reference (BCR) compound 71 consisting mainly of N-(4-bromophenyl)-N′-(2-chloro-4 nitrophenyl) thiourea (C_{13} H_9 Br Cl N_3 O_2 S) and the C, H, Br, Cl, F and nitrogen contents in the BCR Compound 73 consisting mainly of 1-[1-(4-bromophenylmethyl)-4-piperidinyl]-5-chloro-2-(trifluoromethyl)-1H-benzimidazole (C_{20}, H_{18} Br, Cl F_4 N_3), was carried out to within 0.2% limits (absolute values) for each element. This report contains information on the certification procedure, participating laboratories, experimental procedures (stability tests, homogeneity of the material, certification analysis), results and statistical evaluation.

41178 **(FEI—994) Method of target turn in nuclear-physical analysis of substance.** Teplov, E.V.; Shorin, V.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1980. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700807.

The method of target turn on the basis of spectrometry of nuclear reaction products, its possibilities and its place among other nuclear physical microanalysis methods in problems of measuring substance concentration profiles near the surface, are investigeted. It is shown that the accuracy of determination of the layer depth in the target turn method using modern goniometers is not worse than in the spectroscopy method. The data on the analysis of oxygen in iron, and nitrogen in carbon are presented. The role of the target turn angle in the method of charged particle spectrometry is considered.

41179 **(INIS-mf—6477) Trace elements in Turkish tobacco determined by instrumental neutron activation analysis.** Gulovali, M.C. (Middle East Technical Univ., Ankara (Turkey)). 1977. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82700808.

Thesis.

This study was undertaken to determine the concentration of trace elements in nine different brands of Turkish cigarette tobacco, pipe tobacco and tobacco ash. Instrumental neutron activation analysis was employed, and a gamma-ray spectrometer consisting of 40 cm^3 Ge(Li) detector coupled to 1024 and 4096-channel analyzers were used. Samples were irradiated at a thermal neutron flux of about 10^{13} cm^2 sec^{-1}. Concentrations of Na, K, Sc, Cr, Fe, Co, Zn, As, Se, Br, Rb, Sb, Cs, Ba, La, Ce, Eu, Hf, Hg and Th were determined in tobacco and ash; percent transference of these elements into ash were calculated. It was found out that trace elements in cigarette tobacco are left in the ash but only a small percentage is transferred into the smoke.

41180 **(JINR-R—12-80-379) Coprecipitation of ^{239}Np with $BaSO_4$ in experiments on uranium content determination.** Adamek, A.; Popeko, A.G.; Chuburkov, Yu.T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1980. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700809.

Activation-chemical method of analysis based on ^{239}Np and $BaSO_4$ coprecipitation is developed to determine uranium content in samples with wide varying of chemical composition which have been used for the search of superheavy elements in the nature. ^{239}Np is formed from ^{238}U in the course of sample irradiation with thermal and epithermal neutrons. It is shown that insignificant part of neptunium remains in solution after precipitation. For complete coprecipitation it necessary to reduce neptunium, carefully to tetravalent state. The presence of cadmium in the solution increases neptunium capture with barium sulfate, and Rb and Cs deteriorate its coprecipitation. Neptunium desorption from barium sulfate proceeds slowly (for 2 hours concentrated HNO_3 leaches only 22% of neptunium). The known data do not contradict the notions of isomorphic coprecipitation of tetravalent neptunium with $BaSO_4$.

41181 **(LBL—14051) In situ ultratrace gas detection by photothermal spectroscopy: an overview.** Amer, N.M. (Lawrence Berkeley Lab., CA (USA)). Feb 1982. Contract W-7405-ENG-48. 7p. (CONF-820230—2). NTIS, PC A02/MF A01. Order Number DE82008870.

From Workshop on optical and laser remote sensing; Monterey, CA, USA (9 Feb 1982).

Two photothermal detection schemes, photoacoustic and photothermal deflection, are reviewed in the context of in situ ultrace detection of atmospheric constituents.

41182 (LMF—91, pp 225-228) **^{14}C-labeled diesel exhaust particles: chemical characteristics and bioavailability studies.** Sun, J.D.; Wolff, R.K.; Dutcher, J.S.; Brooks, A.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Little is known about the deposition, retention and biological fate of the organic compounds associated with diesel exhaust particles. In the studies reported here, a one-cylinder diesel engine was operated on diesel fuel spiked with ^{14}C-benzene, ^{14}C-hexadecane or ^{14}C-dotriacontane to generate ^{14}C-labeled diesel exhaust. Approximately 1% of the exhaust radioactivity was associated with the particulate phase of diesel exhaust. Chemical fractionation of the particle extract showed the ^{14}C to be present in each of the various chemical class fractions collected. Serum removed ~ 60% of the dichloromethane extractable radioactivity from these diesel particles while saline removed only ~ 6%. This suggested that the organic compounds may be removed from diesel particles in vivo. Future inhalation exposures of rodents to ^{14}C-labeled diesel ex-

hausts are planned to gain additional information on the health risk of human exposure to diesel exhaust.

41183 **(PB—81-854861) Radiation absorption analysis. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 119p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the theory and experimental and industrial applications of radiation absorption analysis (chiefly gamma rays, beta rays, x-rays, and neutron beams) to identify selected components of various substances and media and to determine the concentrations of components. Analysis of components of solids, fluids, and plasmas are included along with some consideration of radiation measuring instruments. (Contains 117 citations, fully indexed and including a table of contents.)

41184 **(PB—81-856676) Neutron activation analysis: semiconductor materials. January 1976-December 1980 (citations from the Energy Data Base). Report for January 1976-December 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 69p. NTIS PC N01/MF N01.

This retrospective bibliography summarizes the current literature on the use of semiconductor devices in neutron activation analysis as well as the analysis of semiconductor materials using neutron activation analysis techniques. The latter category includes citations on the analysis of trace impurities in semiconductor materials. (Contains 60 citations, fully indexed and including a table of contents.)

41185 **Determination of plutonium isotopic composition by gamma-ray spectroscopy.** Sampson, T.E.; Hsue, S.T.; Parker, J.L.; Johnson, S.S.; Bowersox, D.F. (Los Alamos Scientific Lab., NM (USA)). *Nuclear Instruments and Methods in Physics Research;* **193**: No. 1/2, 177-183(15 Feb 1982).

From 5. symposium on x- and gamma-ray sources and applications; Ann Arbor, MI, USA (10 - 12 Jun 1981).

We discuss the general approach, computerized data analysis methods, and results of measurements used to determine the isotopic composition of plutonium by gamma-ray spectroscopy. The simple techniques are designed to be applicable to samples of arbitrary size, geometry, age, chemical, and isotopic composition. The combination of the gamma spectroscopic measurement of isotopic composition coupled with calorimetric measurement of total sample power is shown to give a totally nondestructive determination of sample plutonium mass with a precision of 0.6% for 1000 g samples of PuO_2 with 12% ^{240}Pu content. The precision of isotopic measurements depends upon many factors, including sample size, sample geometry, and isotopic content. Typical ranges are found to be ^{238}Pu, 1 to 10%; ^{239}Pu, 0.1 to 0.5%; ^{240}Pu, 2 to 5%; ^{241}Pu, 0.3 to 0.7%; ^{242}Pu (determined by isotopic correlation); and ^{241}Am, 0.2 to 10%.

41186 **Comparison of methods of estimating body fat in normal subjects and cancer patients.** Cohn, S.H. (Brookhaven National Lab., Upton, NY); Ellis, K.J.; Vartsky, D.; Sawitsky, A.; Gartenhaus, W.; Yasumura, S.; Vaswani, A.N. *American Journal of Clinical Nutrition;* **34**: 2839-2847(Dec 1981). Contract AC02-76CH00016.

Total body fat can be indirectly estimated by the following noninvasive techniques: determination of lean body mass by measurement of body potassium or body water, and determination of density by underwater weighing or by skinfold measurements. The measurement of total body nitrogen by neutron activation provides another technique for estimating lean body mass and hence body fat. The nitrogen measurement can also be combined with the measurement of total body potassium in a two compartment model of the lean body mass from which another estimate of body fat can be derived. All of the above techniques are subject to various errors and are based on a number of assumptions, some of which are incompletely validated. These techniques were applied to a population of normal subjects and to a group of cancer patients. The advantages and disadvantages of each method are discussed in terms of their ability to estimate total body fat.

41187 **RIS and one atom detection.** Lyon, W.S. (Oak Ridge National Lab., TN (USA)). *Radiochemical and Radioanalytical Letters;* **49**: No. 3, 137-141(3 Oct 1981).

A short account on Resonance Ionization Spectroscopy (RIS) and its applications are given. Application of RIS for cosmochemical, geochemical and oceanic research problems have also been suggested. In theory RIS offers a 10^5 increase in sensitivity over conventional methods.

41188 **Carbon-carbon coupling in [3-$^{13}C_1$]tryptophan.** London, R.E. (Los Alamos Scientific Lab., NM). *Organic Magnetic Resonance;* **17**: No. 2, 134-137(1981).

Carbon-carbon coupling constants have been observed in [90% 3- $^{13}C_1$]tryptophan and used to assign the ^{13}C resonances of the indole ring. The results support a reassignment of C-5 and C-6 recently suggested on the basis of the reassignment of the corresponding resonances in indole. Coupling constants are compared with theoretical values obtained using a finite perturbation theory Blizzard-Santry program, and excellent agreement is obtained for the $^1J(CC)$ values. The calculations predict that the Fermi contact contribution is dominant for all /sup n/J(CC) couplings to C-3.

41189 **Potentiometric microdetermination of oxiranes.** Selig, W. (Univ. of California, Livermore). *Mikrochimica Acta;* **1**: 113-118(1980). Contract W-7405-ENG-48.

A potentiometric microtitration for the determination of high molecular weight oxiranes is presented. It is based on the reaction of oxiranes with quaternary ammonium bromide and titration with 0.01 N perchloric acid. The preferred solvent is acetic acid although small amounts of toluene or chloroform may be used. Epoxy equivalents as high as 370,000 have been determined.

41190 **Dose response for benzo(a)pyrene adducts i mouse epidermal DNA.** Pereira, M.A.; Burns, F.J.; Albert, R.E. (New York Univ. Medical Center, NY). *Cancer Research;* **39**: 2556-2559(Jul 1979). Contract EY-76-S-02-2737.

The dose dependency of the binding of benzo(a)pyrene (BaP) with DNA of mouse epidermis was investigated. BaP-conjugated epidermal DNA was isolated and enzymatically degraded to deoxyribonucleosides. The BaP-DNA adducts were separated by Sephadex LH-20 column or high-performance liquid chromatography. Two major BaP-DNA adducts were found. One was in the region of the elution profile that contained polycyclic aromatic hydrocarbons adducted to deoxyribonucleosides. The other adduct was eluted before the deoxyribonucleosides and after deoxyribonucleotides. Both adducts of BaP in epidermal DNA reached a maximum 7 h after a single skin application, and subsequently little, if any, loss of adducts was observed for 49 h. Both adducts varied as a linear function for topical doses in the range from 0.01 to 300 μg/mouse. The formation of DNA adducts by BaP occurred in proportion to dose at doses several orders of magnitude below those that are feasible to test for carcinogenicity.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 40105, 40330, 41202, 41203, 41210, 41331

41191 **(AD-A—103901/5) Overtone vibrations of OH groups in fused silica optical fibers. Technical report.** Stone, J.; Walrafen, G.E. (Howard Univ., Washington, DC (USA). Dept. of Chemistry). Sep 1981. Contract N00014-80-C-0305. 55p. NTIS, PC A04/MF A01.

The OH-stretching fundamental, and the first, second, and third OH overtone vibrations have been examined using pure and GeO2 - doped graded index, fused silica optical fibers having OH contents from less than 1ppm to greater than 1,000 ppm. The previously reported component substructure of the fundamental vibrations of fused silica. Several new vibrations were uncovered and assigned. Examinations of deuterated OH samples helped to verify the assignments. The spectral broadening produced by GeO2 was interpreted in terms of a wider range of environments seen by the OH oscillators, compared to pure fused silica.

41192 **(CNEA—465) Noble gases solubility in water.** Crovetto, R.; Fernandez Prini, R. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Jul 1980. 12p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701033.

The available experimental data of solubility of noble gases in water for temperatures smaller than 330°C have been critically surveyed. Due to the unique structure of the solvent, the solubility of noble gases in water decreases with temperature passing through a temperature of minimum solubility which is different for each gas, and then increases at higher temperatures. As aresult of the analysis of the experimental data and of the features of the solute-solvent interaction, a generalized equation is proposed which enables thecalculation of Henry's coefficient at different temperatures for all noble gases.

41193 **(EIR—392) Thermoanalytical study of selected complexes of inorganic chlorides with ammonia and ammonia derivatives.** Furrer, M. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Apr 1980. 45p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82700811.

Thermoanalytical studies of the reactions between solid inorganic chlorides (NH_4Cl, LiCl, $CaCl_2$, $MnCl_2$, $FeCl_3$) and ammonia or ammonia derivatives have by and large confirmed data published before 1940. Complex stabilities, usually only known for pressures below 1 bar absolute, have been measured at pressures up to 20 bar. The evaluated kinetic data are independent of macroscopic physical parameters such as thickness of the salt layer. The occurrence of a temperature range on both sides of the equilibrium temperature in which kinetics are extremely slow is typical for most of the reactions examined. Very rapid absorption or desorption reactions occur as soon as this hysteresis-gap is overcome. Deviations from this behaviour can be explained by structure anomalies such as the presence of liquid phases.

41194 **(ITEF—175(1980)) Low-temperature phase transformation in rubidium and cesium superoxides.** Alikhanov, R.A.; Toshich, B.S.; Smirnov, L.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1980. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701034.

Crystal structures of rubidium and cesium superoxides which are two interpenetrating lattices of metal ions and oxygen molecule ions reveal a number of phase transformations with temperature decrease. Crystal-phase transformations in CsO_2 are 1-2, 2-3 and low temperature one 3-4 at 378, 190 and 10 K. Low temperature transition is considered as the instability of lattice quadrupoles of oxygen molecule ions to phase transformation of the order-disorder type. Calculated temperatures of low temperature phase transformations in PbO_2 and CsO_2 agree with experimental calculations satisfactory.

41195 **(PB—81-244865) Cryogenic fluids density reference system: provisional accuracy statement (1980).** Siegwarth, J.D.; LaBrecque, J.F. (National Engineering Lab. (NBS), Washington, DC (USA)). Apr 1981. 61p. (NBS-TN—1041). NTIS, PC A04/MF A01.

The improved Density Reference System, the reference densimeter, and the method of determining sample density are described. The uncertainty of the density reference system is + or - 0.055%. The contribution from the estimated systematic error in density was + or - 0.022%. The estimated uncertainty caused by random error is three times the standard deviation of 0.011% and is based on sixty-three measurements of the densities of saturated liquid methane. The total density uncertainty is taken to be the sum of the systematic and random errors. This applies to the density range of 400 to 480 kg/cu m at pressures from 0.8 to 4 bar absolute and temperatures between 109 and 128 K. This accuracy statement is expected to apply over ranges of at least 400 to 1000 kg/cu m in density, 77 to 300 K in temperature and 0.8 to 7 bar in pressure though the accuracy over these ranges has not been verified. Compared to the original, this improved density reference system has greater accuracy, speed, reliability, and flexibility.

41196 **Spectrophotometric measurement of ionic plutonium species in solution at low concentrations.** Swanson, J.L.; Rai, D. (Battelle Pacific Northwest Labs., Richland, WA (USA)). *Radiochemical and Radioanalytical Letters;* **50**: No. 2, 89-97(12 Dec 1981).

Ionic Pu(IV) can be differentiated from other oxidation states in dilute solutions (10^{-7} to 10^{-6}M) by spectrophotometric measurement of the Pu(IV)-Arsenazo III complex. Selective oxidation/reduction reactions were also developed to measure Pu(III) plus Pu(IV) and total ionic plutonium; thus allowing, by difference, determination of Pu(III) and Pu(V) plus Pu(VI).

41197 **Vibrational spectrum ane potential constants for S_2F^{10}.** Jones, L.H.; Ekberg, S.A. (Univ. of California, Los Alamos, NM). *Spectrochimica Acta;* **36A**: 761-767(1980).

The i.r. and Raman spectra of S_2F_{10} vapor have been observed and new assignments have been made for several of the fundamental modes. In particular the band pumped in laser dissociation experiments [1] is an E_1 radial S-F stretch rather than a B_2 axial S-F stretch as earlier assigned [2,3]. From matrix-isolation i.r. spectra some of the ^{32}S-^{32} → ^{32}S-^{34}S isotope shifts have been observed. From the results, with the aid of literature data on SF_6 to make judicious constraints, a general quadratic force field for S_2F^{10} has been estimated; the S-F bonds ae somewhat weaker than those of SF_6. 2 figures, 10 tables.

41198 **Coordination cluster theory: application to ternary reciprocal molten salt systems.** Blander, M.; Saboungi, M.L. (Argonne National Lab., IL). *Acta Chemica Scandinavica;* **34**: 671-676(1980).

The coordination theory (CCT) is extended to ternary reciprocal molten salt solutions of one component (AY) in dilute solution in a binary solvent (AX-BX). Comparison with prior theories of reciprocal systems leads to the identification of the parameters in the CCT theory with quantities which are measurable in the pure constituents and in the four binary subsystems. Predictions of the specific bond free energies for forming associated species between Ag^+ and Cl^- or Br^- ions in sodium and potassium nitrates are made. Although the absolute values of these predicted energies ae 15 to 20% smaller than experimental values, they have the correct relative values for different species in a given solvent and between different solvents for the same species. The CCT theory provides a basis for making predictions of association energies and for correlating and understanding the energetics of association in dilute reciprocal salt solutions.

41199 **Calibration of SEM frozen-hydrated analyses using standard salt solutions and peak to background measurements.** Lai, C.E.; Hayes, T.L. (Univ. of California, Berkeley). pp 800-801 of Thirty-eighth annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). New York, NY; Electron Microscopy Society of America (1980).

A method is described for the analysis of frozen hydrated samples using scanning electron microscopy (SCM) and electron diffraction to provide elemental and morphological information. Two salt solutions, KH_2PO_4 and Na_2SO_3, were analyzed using a peak to local background ratio technique (P/B). The P/B ratios between elements in the solution are consistent for each concentration, and the P/B ratios between the same elements in salt solutions of different concentrations are consistent. Studies with samples of NaCl indicated that the P/B ratio is very sensitive to surface freeze-drying, and care should be taken that a sample is fully hydrated before analysis by the P/B ratio technique. (BLM)

41200 **Coordination chemistry of bis(δ-camphorquinone dioximato)nickel(II) and -palladium(II). Reactions and structural studies of some M_3Ag_3 cluster complexes of camphorquinone dioxime.** Ma, M.S.; Angelici, R.J.; Powell, D.; Jacobson, R.A. (Ames Lab., IA). *Inorganic Chemistry;* **19**: No. 10, 3121-3128(1980).

Reactions of $AgNO_3$ with Ni(δ-HCQD)$_2$ or Pd(δ-HCQD)$_2$, where δ-HCQD$^-$ is δ-camphorquinone dioximato, yielded the hexanuclear metal cluster complexes [Ni(δ-HCQD)$_2$Ag]$_3$ x 2.5$CHCl_3$, Ni-Ag, and [Pd(δ-HCQD)$_2$Ag]$_3$ x 2$CHCl_3$, Pd-Ag, respectively. X-

ray crystallographic studies performed on both complexes showed them to belong to space group $P2_12_12_1$. The unit cell dimensions of Ni-Ag are a = 15.990 (5) A, b = 38.44 (1) A, c = 13.437 (5) A, V = 8260.97 A^3, and Z = 4 while those of Pd-Ag are a = 16.110 (6), b = 38.92 (1), c = 13.393 (3) A, V = 8395.55 A^3, and Z = 4. Block-diagonal least-squares refinement of 3021 observed reflections for Ni-Ag and 6112 for Pd-Ag converged to R/sub F/ = 10.7 and 11.4 (R/sub w/ = 12.7 and 15.0) for the Ni-Ag and Pd-Ag structures, respectively. Their structures indicate that each hexanuclear molecule consists of three individual $M(\delta\text{-HCQD})_2^-$ units which act as multidentate ligands coordinating to a linear chain of three silver atoms. The coordination geometry around each M ion in the $M(\delta\text{-HCQD})_2^-$ units is square planar, and the $\delta\text{-HCQD}^-$ ligands are coordinated to M via N and O atoms. The Ag in the center of the molecule is coordinated to six O atoms with average Ag-O distances of 2.49 (3) and 2.45 (2) A for Ni-Ag and Pg-Ag, respectively. The two silver atoms at the ends of the chain are each coordinated to three nitrogen atoms from the $M(\delta\text{-HCQD})_2^-$ units with average Ag-N distances of 2.20 (4) and 2.27 (3) A, respectively. The Ag-Ag distances, 3.059 (5) and 3.052 (5) A in Ni-Ag and 3.173 (3) and 3.179 (3) A in Pd-Ag, are somewhat longer than those (2.89 A) in Ag metal and indicate that there are Ag-Ag interactions along the linear chains. The bis(pyridine) adduct of $Ni(\delta\text{-HCQD})_2$ was also prepared. A proposed structure for this complex is based on the similarity of its ir spectrum to those of the Ni-Ag and Pd-Ag clusters.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 40135, 40210, 40364, 41200, 41211, 41704

41201 (DOE/ER/10604—2) Metal-ion complexation by ionic crown ethers. Bartsch, R.A. (Texas Tech Univ., Lubbock (USA). Dept. of Chemistry). 22 Dec 1981. Contract AS05-80ER10604. 16p. NTIS, PC A02/MF A01. Order Number DE82011594.

During the second year of the DOE-funded project, rapid progress has been made in three areas: the synthesis of crown ethers which possess pendant carboxylic acid groups; the selectivity and efficiency for solvent extraction of alkali metal and of alkaline earth cations from water into organic solvents by crown ether carboxylic acids; and, the active transport of alkali metal cations across bulk liquid organic membranes by crown ether carboxylic acids.

41202 (EGG-M—00782) Performance of the thermodynamic properties models in ASPEN. Fish, L.W.; Evans, D.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 15p. (CONF-820202—12). NTIS, PC A02/MF A01. Order Number DE82008612.

From AICHE 1982 national winter meeting; Orlando, FL, USA (28 Feb 1982).

In the course of performing a number of analyses using ASPEN, the performance of the ASPEN models for computing thermodynamic properties has been observed. Pure-component properties for propane, isobutane, Freon 12 and Freon 22 and mixture properties for the propane-isobutane and the ethanol-water systems have been computed and the results compared with available data sources and with independent sources of computed properties. The built-in data regression system (DRS) of ASPEN was used to regress P-V-T and enthalpy departure data for isobutane to determine model-specific parameters. The extended Antoine vapor pressure parameters were calculated for Freon 12. The ethanol-water vapor-liquid equilibrium region was studied throughout the composition range for three isobaric data sets. Several activity coefficient models in ASPEN were fit to the data using various user-specified property routes.

41203 Chloride enhancement of quenching of triplet methylene blue by Fe(II). Osif, T.L.; Lichtin, N.N. (Boston Univ., MA). *Photochemistry and Photobiology;* **31**: No. 403-406, 403-406(1980). Contract EY-76-S-02-2889.

The influence of chloride ion on the rate of decay of triplet methylene blue in 0.01 M acid in the absence and presence of ferrous ions was investigated by means of laser flash-photolysis monitored by kinetic spectrophotometry. Chloride weakly accelerates decay of $^3MBH^{2+}$ in aqueous solution in the absence of Fe(II). Quenching of $^3MBH^{2+}$ by Fe(II) is more strongly catalyzed by Cl^- in both water and 50 v/v% aq. CH_3CN. The uncatalyzed quenching constant, k_s, is of the order of $1 \times 10^6\ M^{-1}s^{-1}$ while in 4.8 M aqueous chloride (μ = 7.2 M) $k_s = (37.2 +\text{-} 1.8) \times 10^6\ M^{-1}s^{-1}$. A possible role of chloride is as a bridging species in quenching via electron transfer between $^3MBH^{2+}$ and Fe(II). 2 figures, 2 tables.

41204 Carbon kinetic isotope effect in the oxidation of methane by hydroxyl. Rust, F.; Stevens, C.M. (Argonne National Lab., IL). *International Journal of Chemical Kinetics;* **12**: 371-377(1980).

The carbon kinetic isotope effect in the reaction of CH_4 with OH has an experimentally measured value of 1.003. The measurement was performed using a static system in which the source of OH was the gas-phase photolysis of H_2O_2 with ultraviolet light produced by a high-pressure mercury arc lamp. Implications for the tropospheric cycle of CH_4 are considered briefly. 4 references, 2 tables.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 40834, 40995

41205 (UCID—19319) Molten phosphate electrolyte for the electrolysis of water. Shell, P.K.; Cottrell, P.; Krikorian, O.H. (SEE CODE- 9513035 California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Feb 1982. Contract W-7405-ENG-48. 12p. NTIS, PC A02/MF A01. Order Number DE82008211.

Phosphate-based molten salts are identified as potential electrolytes for the high temperature electrolysis of water and for possible use in the Lithium Hydride Thermochemical Cycle. The behavior of polymeric, partially neutralized phosphoric acid is observed with respect to its thermal stability, ability to receive steam, and its corrosiveness to potential electrode materials. The results of these tests are favorable and warrant further, more quantitative studies of the suitability of phosphate melts as electrolytes for water electrolyis.

4005 Photochemistry

REFER ALSO TO CITATION(S) 40364, 41203, 41204, 41232, 41367, 41470

41206 (EUR—7536-EN) Genetic manipulation of photosystem I and II in chloroplast membranes. Von Wettstein, D.; Lindberg Moller, B.; Hojer-Hansen, G.; Simpson, D. (Carlsberg Lab., Copenhagen (Denmark)). 1981. 15p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Gel electrophoresis of SDS solubilized purified thylakoid membranes from greening barley seedlings has established the presence of a minimum of 43 polypeptides (Hoyer-Hansen and Simpson, 1977). A review of the literature reveals that at least 30 different polypeptides are implicated in the photosynthetic function of these membranes. Other properties of thylakoids, such as chlorophyll biosynthesis, require additional membrane polypeptides. The aim of this project is to identify the function and localization of thylakoid polypeptides with the aid of mutants in barley.

41207 (EUR—7566-EN) Effect of the electrical field in the membrane of photosynthesis. Witt, H.T.; Graeber, P.; Renger, G.; Schlodder, E.; Tiemann, R.; Eckert, H.J.; Sewe, K.U. (Technische Univ. Berlin (Germany, F.R.)). 1981. 101p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The primary process of photosynthesis is a vectorial redox reaction within special reaction centers embedded in the photosynthetic membrane. This reaction simultaneously generates a transmembrane electric field, the inside of the photosynthetic vesicle becoming positive with respect to the outside. This work is addressed to several different aspects of the primary processes: (1) the effect

of external electric fields on membrane components and partial reaction of photosynthesis; (2) the mechanism of redox reaction of chlorophyll a II; (3) the organization of carotenoid chlorophyll complexes; and (4) the transmembrane electric potential differences is steady state using electrochronic absorption changes. (DMC)

41208 **(PNL-SA—10222) Photochemistry of 1 and 2-(2-methylphenyl)-1,6-heptadiene.** Barrows, R.D.; Hornback, J.M. (Battelle Pacific Northwest Labs., Richland, WA (USA); Denver Univ., CO (USA). Dept. of Chemistry). 1982. Contract AC06-76RL01830. 26p. (CONF-820304—13). NTIS, PC A03/MF A01. Order Number DE82008584.

From 183. American Chemical Society annual meeting; Las Vegas, NV, USA (27 Mar 1982).

In an attempt to synthesize partially saturated phenanthrene derivatives by an intramolecular Diels-Alder reaction between a photochemically produced o-xylylene (diene) and a tethered dienophile, it was found that 1 and 2 underwent a photochemically allowed [2 + 2] cycloaddition. Irradiation of 1 gave 6-(2-methylphenyl)bicyclo[3.2.0]heptane in 86% yield. Upon irradiation of 2, a benzvalene rearrangement of 2 first took place, producing the meta isomer 2-(3-methylphenyl)-1,6-heptadiene, followed by a [2 + 2] photocycloaddition giving 1-(3-methylphenyl)bicyclo[3.2.0]heptane in 15% yield. Direct irradiation of 2-(3-methylphenyl)-1,6-heptadiene gave the same bicyclo derivative as 2 in 34% yield. Examination of the fluorescence spectra of 1 and 2 in comparison with 1-(2-methylphenyl)propene and 2-(2-methylphenyl)-1-butene, respectively, has shown that 1 may be biased toward [2 + 2] cycloaddition where 2 is not biased toward [2 + 2] photocycloization. Attempts to produce 4a-methyl-1,2,3,4,4a,9,10,10a-octahydrophenanthrene by an intramolecular Diels-Alder reaction of the o-xylylene produced by irradiation of 3 will also be described.

41209 **Multiple pathways of tryptophan photoionization.** Grossweiner, L.I.; Brendzel, A.M.; Blum, A. (Illinois Inst. of Tech., Chicago). *Chemical Physics (Amsterdam);* 1-9(1981). Contract AS02-76EV02217.

Laser flash photolysis studies have been carried out on aqueous tryptophan at 265 nm and with simultaneous excitation at 265+530 nm for different conditions of intensity, temperature, in water-ethanol solutions and in the presence of high bromide ion concentrations. A monophotonic ionization pathway requiring thermal assistance and a temperature-independent, solvent-dependent biphotonic ionization pathway have been identified, neither of which involves the triplet state or the fluorescent state. Similar results have been observed with aqueous indole and for survey experiments on other indole derivatives, tyrosine, and several enzymes. A new photoionization mechanism is proposed in which monophotonic ionization takes place from a short-lived, pre-fluorescent state and the biphotonic ionization intermediary is an unidentified state of about 1 ns lifetime absorbing at 530 nm, populated in competition with internal conversion to the fluorescent state.

41210 **Kinetic studies of organochromium(III) cations and their hydrido analog.** Ryan, D.A.P. Ames, IA; Iowa State Univ. (1981). 259p. University Microfilms Order No. 81-23,127.

Thesis (Ph. D.).

The complex $HOCH_2CH_2Cr(H_2)_5^{2+}$ and $HCr(H_2O)_5^{2+}$ were prepared by flash photolysis in dilute aqueous $HClO_4$ and by uv flash photolysis in aqueous Cr(III) perchlorate solutions, respectively. The kinetics of the reaction of both complex species with H_3O^+ were studies and rate laws for the reactions were determined. The deuterated complex $DCr(D_2O)_5^{2+}$ showed a large kinetic isotope effect in its reaction with D_3O^+ which is similar in magnitude to the acidolysis of the $CH_3Cr(D_2O)_5^{2+}$ ion by D_3O^+. These findings are supportive of a mechanism where the O-H bond breaking is the rate-limiting reaction for both complexes. Protonolysis of $HCr(H_2O)_5^{2+}$ was proposed to occur via a nonlinear three-center transition state in which the H-Cr bond is still intact. (BLM)

41211 **Thermal and photochemical transformations of hetero-1,3,5-hexatrienes into five-membered rings: possible pericyclic reactions.** George, M.V.; Mitra, A.; Sukumaran, K.B. (Indian Inst. of Tech., Kanpur). *Angewandte Chemie, International Edition in English;* **19**: No. 12, 973-983(Dec 1980).

Heterosubstituted 1,3,5-hexatrienes undergo thermal and photochemical cyclizations, most of which can be viewed as pericyclic reactions. Numerous cyclizations of this type have been reported in the literature. This article presents a systematic account of such reactions, classified according to the number and nature of the heteroatoms.

41212 **Photoinduced oxidation of axial and macrocyclic ligands in a copper(II) complex.** Muralidharan, S.; Ferraudi, G. (Univ. of Notre Dame, IN). *Inorganica Chimica Acta;* **45**: L33-L34(1980).

It was recently reported that ultraviolet irradiations of $Cu([14]dieneN_4)^{2+}$ (I) and $Cu([13]AtH)^{2+}$ (II) induce ligand hydrolysis and redox processes. These photoreactions have been attributed to photoactive charge-transfer metal to ligand states, CTTL, which involve isolated imino functions of the macrocycles. Moreover, the cha0ge-transfer ligand to metal states, CTTM, seem to be photoinert in these complexes. Macrocyclic ligands with coordinated amino groups, namely as in complexes of tet-a and tet-b (III), cannot produce CTTL states at accessible energies. Therefore, these compounds can be conveniently used for an investigation of the CTTM reactivity. Our results show, for the first time, that two distinct photoredox processes are involved in the photochemistries of the tet-a and tet-b complexes [3].

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 41721

41213 **(AERE-R—10027) Radiation chemistry of heterogeneous and homogeneous nitrogen and water systems.** Linacre, J.K.; Marsh, W.R. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jun 1981. 71p. NTIS (US Sales Only), PC A04/MF A01; Also available from H.M. Stationery Office, price Pound4.00. Order Number DE82700710.

Measurements were made of the radiation chemical products such as nitric acid formed when nitrogen gas mixtures in the presence of water vapour and liquid were irradiated with the mixed neutron/gamma field of the BEPO reactor to doses of ca 10^{21} to 10^{23} eVg^{-1}. The water was analysed for NO_3^-, NO_2^- and NH_4^+ ions, also for H_2O_2, NH_2OH and N_2H_4. The investigation was aimed at obtaining information relevant to the DIDO and PLUTO reactors, but the results are of more general interest. The results are discussed in terms of reactions to be expected, especially those of N atoms, and are compared with those of other work on radiation and gas discharge chemistry.

41214 **(JAERI-M—9856) Annual report No. 14 of the Osaka Laboratory for Radiation Chemistry, Japan Atomic Energy Research Institute, April 1, 1980-March 31, 1981.** (Japan Atomic Energy Research Inst., Neyagawa, Osaka. Osaka Lab. for Radiation Chemistry). Dec 1981. 139p. Japan Energy Research Institute, Information Section, Division of Technical Information, Tokai-mura, Naka-gun, Ibaraki-ken, Japan.

Reported are studies on: radioinduced reactions of CO, H_2, and CH_4; radioinduced polymerization of styrene and butadiene; modification of polymers by grafting; and radioluminescence by Ar containing trace water and nitrogen. 71 figures, 22 tables. (DLC)

41215 **Der einflub der strahlenbehandlung auf lebensmittel eine literaturstudie. Teil V. (Effects of irradiation on foodstuffs: a literature review. Part V).** Kalb, M.; Boegl, W. Berlin, Germany; Dietrich Reimer Verlag (1981). 213p. (STH—6/1981). Dietrich Reimer Verlag, Unter den Eichen 57, 1000 Berlin 45, Germany.

When using ionizing radiation for preservation or for retardation of ripening not only pathogenic or putrefactive microorganisms or parasites contained in the individual foodstuffs are damaged but, simultaneously, radiochemical transformations are caused which may lead, under certain conditions, to subsequent products detrimental to health. Another problem is the radiation decomposition of biologically important components, such as vitamins, amino acids, or fatty acids. In the present study the results of irradiation tests in 34 different foodstuffs and 4 model substances have been reviewed and compiled. The purpose is to give a survey of the chemical transformations of irradiated foodstuffs. Microbiological and toxicological aspects were not taken into consideration. The results published by the authors of the original studies were collected and listed in a uniform way to provide all the necessary data like source of radiation, conditions of radiation, treatment and nature of the sample, tests and methods, results of the chemical and organoleptic changes.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 41174, 41302, 41531, 41554

41216 (BARC—1087) Kinetics of interfacial reaction between uranium dioxide and zircaloy-2. Paul, A.R.; Naik, M.C.; Venkateswarlu, K.S. (Bhabha Atomic Research Centre, Bombay (India)). 1980. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700810.

Solid state reaction between UO_2 pellets and zircaloy-2 has been studied at temperature between 1270 and 1775 K. It has been observed that the reaction results in the formation of three layers. The kinetics of growth of these layers have been studied in depth and are found to obey parabolic relation with annealing time. The temperature dependence of the growth rate of these reaction layers obeys an Arrhenius type of relation. Micro cracks and longitudinal gaps were observed in some of the couples (towards UO_2 pellet side) annealed for longer period. The presence of gaps and cracks suggests that the reaction is assisted by a process involving stress and strain in the reaction zone set up by differential contraction between uranium dioxide and reaction layers.

41217 (CNEA—455) Preparation of clomifene ^{131}I. Suner, A.A.; Mitta, A.E.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Nov 1979. 7p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701036.

A technique for the preparation of clomifeno ^{131}I and the influence of different variables on the labelling are described.

41218 (CNEA—458) Labelling of intralipid 10% with ^{131}I. Suner, A.A.; Mitta, A.E.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Apr 1980. 6p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701037.

The labelling of intralipid 10% with ^{131}I is described. Radiochemical yield is 100%.

41219 (CNEA—460) Equipment for the extraction of ^{99}sup(m)TcO$_4$Na. Pliego, O.H.; Fraga de Suarez, A.H.; de Goncalvez, M.; Marques, R.; Guerrero, G.; Mitta, A.E.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Apr 1980. 12p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701038.

An equipment is described for the extraction of ^{99}sup(m)Tc by the liquid-liquid extraction method, installed at the Nuclear Medicine Center of the Hospital de Clinicas "Jose de San Martin".

41220 (CNEA—461) Preparation of ^{99}sup(m)Tc pyridoxylideneglutamate as an imaging agent for gall bladder. Fraga de Suarez, A.; Mitta, A.E.A.; Parera, V.E. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Apr 1980. 8p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701039.

The preparation of pyridoxylideneglutamate ^{99}sup(m)Tc is described ITLC (S.G.) is suggested as a test method, the compound was assayed in rabbits and the stability of a non-lyophilized kit was determined.

41221 (IA—1364, pp 203) Synthesis of tetraphenylphosphonium bromide (phenyl-^{3}H). Shimoni, M.; Hagag, Y.; Buchman, O. Jul 1981. Dep. NTIS (US Sales Only).

In Research laboratories annual report 1980.

41222 (JINR-R—6-80-553) Effect of dilution in reactions of substitution of chlorine and hydrogen for hot astatine atoms in chlorobenzene. Vasharosh, L.; Norseev, Yu.V.; Khalkin, V.A.; Berei, K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1980. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701041.

The effect of dilution of chlorobenzene by xenon in a gas phase is studied as well a carbon tetrachloride, hexafluorobenzene and triethylamine (TEA) in a liquid phase on the yield of products of substitution of hydrogen (Rsub(H)) and chlorine (Rsub(Cl)) for astatine-211 atoms produced in nuclear transformation of ^{211}Rn into ^{211}At. Main attention has been paid to the variation of chlorine and hydrogen substitution product yields as well as on astatine-211 distribution among isomeric products of substitution of hydrogen for hot astatine atoms. On the basis of experimental data a conclusion is drawn on the mechanism of interaction of astatine-211 high energy atoms with chlorobenzene.

41223 (JINR-R—12-81-41) Isolation of some radioelements from metallic cyclotron targets by volatilization in air flow and separation using selective chemical filters. 1. Zhuikov, B.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1981. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701040.

Carrier-free Pt, Ir, Os, Re, Tc radioisotopes were isolated from metallic tantalum, tungsten and niobium targets irradiated with accelerated ^{12}C and by heating in air flow. Rapid and complete extraction is achieved at 1200-1250 deg C. Pt and Ir isotopes were separated in air flow by means of a filter of metallic gold (1000 deg C) which absorbs Pt. Re and Os isotopes were separated by means of filters of CaO (1000 deg C) or MgO (850-1150 deg C) which absorb Re. Separation coefficients exceed here 10^3.

41224 (LA—9199-MS) Uranium immobilization and nuclear waste. Duffy, C.J.; Ogard, A.E. (Los Alamos National Lab., NM (USA)). Feb 1982. Contract W-7405-ENG-36. 28p. NTIS, PC A03/MF A01. Order Number DE82009082.

Considerable information useful in nuclear waste storage can be gained by studying the conditions of uranium ore deposit formation. Further information can be gained by comparing the chemistry of uranium to nuclear fission products and other radionuclides of concern to nuclear waste disposal. Redox state appears to be the most important variable in controlling uranium solubility, especially at near neutral pH, which is characteristic of most ground water. This is probably also true of neptunium, plutonium, and technetium. Further, redox conditions that immobilize uranium should immobilize these elements. The mechanisms that have produced uranium ore bodies in the Earth's crust are somewhat less clear. At the temperatures of hydrothermal uranium deposits, equilibrium models are probably adequate, aqueous uranium (VI) being reduced and precipitated by interaction with ferrous-iron-bearing oxides and silicates. In lower temperature roll-type uranium deposits, overall equilibrium may not have been achieved. The involvement of sulfate-reducing bacteria in ore-body formation has been postulated, but is uncertain. Reduced sulfur species do, however, appear to be involved in much of the low temperature uranium precipitation. Assessment of the possibility of uranium transport in natural ground water is complicated because the system is generally not in overall equilibrium. For this reason, Eh measurements are of limited value. If a ground water is to be capable of reducing uranium, it must contain ions capable of reducing uranium both thermodynamically and kinetically. At present, the best candidates are reduced sulfur species.

41225 (LMF—91, pp 22-27) In vitro measurements of the release of ^{232}U and its daughters from UO_2 particles by dissolution, alpha-recoil and inert gas diffusion. Coombs, M.A.; Cuddihy, R.G. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Three mechanisms that are potentially important in the release of ^{233}U and its decay products from UO_2 particles in the lungs were studied in vitro. Particles of UO_2 uniformly labeled with 1% ^{233}U were aerosolized and separated by aerodynamic size in a Lovelace Aerosol Particle Separator. Monodisperse size fractions ranging from 0.7 to 2.5 μm activity median aerodynamic diameter were used to study release of radionuclides by particle dissolution, recoil of atoms after alpha-decay and diffusion of the inert gas, ^{220}Rn.

41226 (LMF—91, pp 53-57) **Calibration of initial pulmonary burden measurement method using ^{169}Yb whole body counting.** Diel, J.H.; Guilmette, R.A.; Kanapilly, G.M.; Lundgren, D.L.; Mewhinney, J.A.; Muggenburg, B.A.; Snipes, M.B.; Stanley, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Four adult Beagle dogs of different weights were exposed by inhalation to an ^{169}Yb-labeled aerosol of $^{239}PuO_2$. The Pu burdens of the dogs were computed using whole-body counting of the ^{169}Yb and radiochemical analysis for ^{239}Pu. The ^{169}Yb determination was found to predict the results of the radiochemical analysis for ^{239}Pu with a 95% confidence interval of +- 50% of the measured body burden.

41227 **(PB—81-854994) Radioisotope production by radioisotope generators. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 137p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning isotope generation and generator systems. Methods for production, separation, purification, and quality control are considered in general and with regard to specific radioisotopes and specific radioisotope applications. (Contains 142 citations, fully indexed and including a table of contents.)

41228 **(ZfK—445) 10 years production of tritium labelled compounds in Rossendorf.** Roemer, J.; Pleiss, U.; Teich, A.; Mittag, E.; Brankoff, T. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jun 1981. 23p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700813.

The present work gives a survey on the methods which are applied to prepare tritium labelled compounds. Using different examples exchange procedures and specific labelling reactions are explained more thoroughly. The mentioned labelling reactions have been carried out in our laboratory in the last decade. The tritium labelled products were applied in many research laboratories. According to prognostic evaluations tritium labelled compounds will be used on a larger scale in future in order to solve problems of life science. With the present work the authors intend to give an effective support to future users.

41229 **(ZfK—448) Radiopharmaceuticals - current state and trends.** Muenze, R. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jul 1981. 18p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700814.

The current state as well as the tendencies of modern radiopharmaceutical development and application is reviewed. After an evaluation of the fundamental preconditions of decay characteristics and pharmaceutical properties the problems concerning sup(99m)Tc-radiopharmaceuticals, metabolizable compounds and the use of specific biological interactions are discussed.

41230 **X-ray dichroism and polarized anomalous scattering of the uranyl ion.** Templeton, D.H.; Templeton, L.K. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Acta Crystallographica, Section A: Crystal Physics, Diffraction, Theoretical and General Crystallography;* **38**: No. 1, 62-67(1 Jan 1982).

Dichroism is observed near the L_1 and L_3 edges of uranium in X-ray absorption spectra of single-crystal rubidium uranyl nitrate, $Rb.UO_2.3NO_3$, recorded with linearly polarized synchrotron radiation. The anomalous X-ray scattering terms f' and f'' calculated from these spectra are anisotropic functions of polarization direction at these wavelengths, adding new complexity to diffraction optics. These terms are measured independently in diffraction experiments with sodium uranyl acetate at five wavelengths near L_3. The cubic symmetry permits the diffraction effects to be observed without the complications of macroscopic dichroism and birefringence. Both f' and f'' change with polarization direction by as much as 2 electrons $atom^{-1}$. These values agree with those derived from the absorption experiments.

41231 **Production of negative ions of hydrogen isotopes.** Garscadden, A. US Patent Application 6,263,629629. 14 May 1981. 24p.

A process for generating negative ions of hydrogen isotopes is described which comprises cooling the hydrogen gas below 300K, and preferably to about 200K, vibrationally exciting the molecules of the gas, and then dissociating the molecules by electron impact into neutral hydrogen atoms and negative hydrogen ions. Alternatively, the gas may first be vibrationally excited by heating or the like, and then cooled translationally, for example, by rapid expansion prior to dissociation by electron impact. The processes of this invention are characterized by control of non-equilibrium conditions to obtain large increases in dissociative attachment rates by increasing the population of hydrogen gas molecules having a higher vibrational energy state.

41232 **Laser-induced emission spectrum of UF_6.** Rice, W.W.; Wampler, F.B.; Oldenborg, R.C.; Lewis, W.B.; Tiee, J.J.; Pack, R.T. pp 727-730 of Proceedings of the international conference on lasers '80. Los Alamos, NM; Los Alamos Scientific Laboratory (1980).

The laser-induced emission from KrF-laser irradiation of gaseous, room temperature UF_6 has been studied as a function of time, wavelength, pressure, and laser fluence. One group of 17 UF_6 emission peaks has been identified. 5 figures, 1 table.

41233 **Interphase transfer kinetics of thorium between nitric acid and tributyl phosphate solutions using the single drop and the Lewis cell techniques.** Horner, D.E.; Mailen, J.C.; Coggins, J.R. Jr.; Thiel, S.W.; Scott, T.C.; Pih, N.; Yates, R.G. (Oak Ridge National Lab., TN). *Industrial and Engineering Chemistry Fundamentals;* **19**: 286-291(1980). Contract W-7405-ENG-26.

The kinetic rate constants for the interphase transfer of thorium between an aqueous phase and an organic phase of tributyl phosphate-n-paraffin hydrocarbon have been measured using the single drop and the Lewis cell techniques. Results from individual tests performed with the two techniques agree within experimental error. As with uranium, the data are consistent with a model in which the rate-controlling step is the rate of reaction of the components at the phase interface. An organic-soluble complex, represented by $Th(NO_3)_4.2TBP$, forms in the organic phase. The composition of this complex is confirmed by equilibrium, as well as by kinetic, data. The kinetic data include results from tests showing the effects of TBP concentration and nitrate concentration on the values of the forward and the reverse kinetic constants. Other tests show the effect of temperature on the kinetic constant in both the forward and the reverse transfer directions, and the activation energies and enthalpy for the extraction reactions were estimated from these data. Unlike uranium, thorium extraction was shown to have a Marangoni effect under certain conditions. 10 figures, 1 table.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

41234 **(AD-A—098103/5) Fuels combustion research. Annual report, October 1979-30 September 1980.** Glassman, I.; Dryer, F.L. (Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering). 27 Feb 1981. 36p. NTIS PC A03/MF A01.

A high temperature sampling system for the Princeton flow reactor has been developed. Initial results have been obtained on the oxidation of toluene. Benzaldehyde forms as an important intermediate and then the process becomes one of the oxidizing formly and phenyl reactions. The effects of oxygen index and temperature on sooting diffusion flames have been studied. Results indicate that the stoichiometric flame temperature dominates the sooting tendency and that the C4 and C5 olefin and diolefins and the aromatics are the most dominant sooting fuels. In development, as well are a powerful family of sensitivity analysis tools to quantitatively address the complex interaction between a combustion system's chemical and transport component.

41235 **(AD-A—103932/0) Application of coherent anti-stokes raman scattering to combustion media. Final technical report 31 May 77-30 Jul 80.** Goss, L.P.; Switzer, G.L. (Systems Research Labs., Inc., Dayton, OH (USA). Research Applications Div.). Feb 1981. Contract F33615-77-C-2019. 168p. NTIS, PC A08/MF A01.

A laboratory-based system utilizing the Nd:YAG laser has been developed to investigate the Coherent Anti-Stokes Raman Scattering (CARS) of molecular gases in combustion. Single-shot and simultaneous experimental measurements of species concentration and temperature of combustion media are reported and compared with other optical techniques and theoretical predictions. The adverse effects of beam propagation through turbulence are investigated and discussed. A transportable hardened CARS system, constructed to operate in adverse environments, has been used to conduct a series of investigations in a practical combustion tunnel. Temperature and number-density measurements made as a function of fuel-air flow, position in the combustion tunnel, and fuel variation--including both gaseous and liquid fuels--are reported.

41236 **(DOE/ER/10969—1) Simultaneous multipoint measurements of density gradients and temperature in a flame. Progress report, July 1, 1981-January 31, 1982.** Chang, R.K.; Chu, B.T.; Long, M.B. (Yale Univ., New Haven, CT (USA)). Feb 1982. Contract AC02-81ER10969. 6p. NTIS, PC A02/MF A01. Order Number DE82008909.

A brief account is given of progress in developing new non-intrusive in situ optical techniques and applying these techniques to study turbulent reacting flows. Progress has been made in three main areas: (1) the use of Rayleigh scattering to map the instantaneous spatial concentration field at 10,000 points within a nonreacting turbulent flow; (2) the initiation of Ramanography experiments for measuring the instantaneous concentration field of various gas components within a turbulent diffusion flame; and (3) the feasibility of using CARS for making spatially resolved flame temperature measurements within a turbulent diffusion flame.

41237 **(NASA-CR—161814) High-pressure LOX/hydrocarbon preburners and gas generators. Final Report, Dec 1978 - Apr 1981.** Huebner, A.W. (Rocketdyne, Canoga Park, CA (USA)). Apr 1981. 192p. NTIS PC A09/MF A01.

The objective of the program was to conduct a small scale hardware test program to establish the technology base required for LOX/hydrocarbon preburners and gas generators. The program consisted of six major tasks Task I reviewed and assessed the performance prediction models and defined a subscale test program. Task II designed and fabricated this subscale hardware. Task III tested and analyzed the data from this hardware. Task IV analyzed the hot fire results and formulated a preliminary design for 40K preburner assemblies. Task V took the preliminary design and detailed and fabricated three 40K size preburner assemblies, one each fuel-rich LOX/CH, and LOX/RP-1 and one oxidizer rich LOX/CH4. Task VI delivered these preburner assemblies to MSFC for subsequent evaluation.

41238 **(PB—82-108358) Fuel decomposition and flame reactions in conversion of fuel nitrogen to NOx. Final report Jun 75-Apr 78.** Axworthy, A.E.; Kahn, D.R.; Dayan, V.H.; Woolery, D.O. II. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). 1978. Contract EPA-68-02-1886. 297p. NTIS, PC A13/MF A01.

The report describes an experimental and analytical research program conducted to provide information on the chemical phenomena involved in the conversion of air and fuel nitrogen to NOx. Under Task 1, Fuel Decomposition, early (preflame) reactions of fuel nitrogen species were investigated using one- and two-stage reactors. Inert pyrolysis experiments, carried out with several fuel oils, showed that the primary nitrogen-containing product was a tarry material that decomposed to HCN at high temperature (1100 C). Oxidative pyrolysis experiments, involving model compounds (pyridine, benzonitrile, NH3, and HCN), fuel oils, and coals showed that the primary products were NH3 and HCN at lower temperature, and N2 and N2O at higher temperature. Task 2, Combustion Kinetics, was carried out in a low-pressure flat flame burner. The formation of thermal, prompt, and fuel NO was investigated in CH4-O2-N2 flames doped with NH3 or HCN. In addition, the formation of fuel NO was investigated in a H2-CO-O2-Ar-NH3 flame. This simulated the combustion of a future low-Btu fuel containing NH3 as an impurity. HCN was shown to be a significant intermediate for all flames where the fuel contained hydrocarbon. Calculations were made during Task 3, Data Analysis, on the H2-CO-O2-Ar-NH3 flame using a detailed kinetic-diffusion model.

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4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 40275, 41337, 41374

41239 **Optical lithographic technique for fabricating submicron-sized Josephson microbridges.** Jelks, E.C.; Kerber, G.L.; Wilcox, H.A. US Patent Application 230,246. [nd]. Filed date 2 Feb 1981. 12p.

Planar superconducting-normal-superconducting (SNS) Josephson microbridges and superconducting quantum interference devices (SQUIDs) with bridge widths of about 0.2 microns and lengths of about 0.1 micron or less are fabricated with the aid of a technique referred to as 'shadow evaporation'. The procedure permits the submicron dimensions to be set by edge film thickness and slant evaporation angle, both of which can be accurately measured. Microbridges have been constructed with vanadium banks or electrodes and gold-titanium bridges, although other materials can be used including superconducting metals for the bridge. It is expected that a refined version of this technique would be suitable for repeated batch fabrication of single and multiple Josephson microbridges.

41240 **(AD-A—102800/0) Swept-excited amplifiers and fluctuations and correlations in cooperative processes. Final report.** Bonifacio, R. (Milan Univ. (Italy)). May 1981. 6p. NTIS, PC A02/MF A01.

Optical Bistability, Josephson Junctions, Superfluorescence and Free Electron Lasers (FEL) have been studied. The first theoretical evidence has been obtained of the possibility of high intensity, chaotic collective spiking behaviour of a FEL for high enough electron density and strong enough magnetic wiggler field.

41241 **(AR—002-247) Simulation of local stess-strain behavior with aplication to fatigue analysis. Structures report 385.** Fraser, R.C. (Aeronautical Research Labs., Melbourne (Australia)). 1981. 29p. Chief Superintendent, Aeronautical Research Laboratories, Box 4331, P.O. Melbourne, Victoria, 3001, Australia.

Substantial improvement in fatigue life prediction has been effected by the introduction of cyclic stress-strain concepts. A procedure that incorporates these in a simulation of local stress and strain from nominal load using Neuber notch analysis is described in relation to its application to the fatigue analysis of in-service load histories. In the present simulation the non-linear stress-strain and Neuben equations are solved numerically rather than by piecewise approximations. For the long load histories occurring in practice this improves numerical stability.

41242 **(KFK—3137) Studies of helium breakdown at low temperatures.** May, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Apr 1981. 106p. (In German). Kernforschungszentrum Karlsruhe GmbH, Germany.

For designing cryogenic installations the breakdown strength of helium at temperatures near absolute zero has to be known. Various breakdown strengths are reported in literature concerning liquid helium. It is the objective of these studies to find an explanation for the different breakdown strengths by suitable variation of parameters. Various electrode materials commonly used in low temperature techniques with different sample preparation are used to measure breakdown strength of liquid helium in the gap range from 0.5 mm to 3 mm. A substantial influence of roughness, oxide layer and microcracks on strength is revealed. These terms are summarized and defined as condition of the electrode surface. Taking this into account the various breakdown strengths can be qualitatively explained. Based on these results breakdown strength in supercritical high density helium is examined. A Paschen-curve can be given for this thermodynamical region. Besides the influences of material additional parameters are observed which influence breakdown and give information of its development.

41243 **(NASA-CASE-ARC—11263-1) Refrigerator module, system and process.** Brooks, W.F.; Kittel, P. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Jun 1981. 15p. NTIS, PC A02/MF A01.

A hermetically sealed, valve-free assembly containing helium 3 or other refrigerant is used in a refrigerator module including a refrigerant evaporator, a refrigerant condenser, and a refrigerant adsorption pump serially connected but thermally isolated, so that the refrigerant may pass from one element to another. A heater is provided for the adsorption pump. During operation, the adsorbing unit is heated to drive adsorbed refrigerant vapor to the condenser. Refrigeration occurs when the refrigerant is evaporated in the evaporator and simultaneously adsorbed in the adsorbing unit to decrease refrigerant vapor pressure. When connected to the cold plate of a helium 4 or other refrigerant cryostat, the resulting multistage refrigeration system gives improved and simplified operation in practice.

41244 **(PB—81-197154) Thermal degradation products of solvents and hydraulic fluids used in mining. Report of investigations/1981.** Christos, T.; Forshey, D.R. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Mar 1981. 20p. NTIS, PC A02/MF A01.

The Bureau of Mines sponsored an investigation of the thermal oxidative degradation characteristics of certain solvents and hydraulic fluids used in underground mining operations. The following halogenated solvents were studied in view of their usefulness and their flame retardant property: tetrachloroethylene, Cl2C = CCl2; 1, 1, 2-trichloroethane, ClH2CCHCl2; and trichloroethylene, Cl2C = CHCl. The hydraulic fluids studied were representative of five groups approved by the Mine Safety and Health Administration for underground operation, namely: glycol-water solutions, mineral oil-water emulsions, synthetics other than phosphate esters, synthetic phosphate esters, and mixtures of phosphate esters with mineral oils and other ingredients.

41245 **(PB—81-234734) Training of epoxy-impregnated superconductor windings. Final report.** Ekin, J.W.; Schramm, R.E.; Superczynski, M.J. (National Bureau of Standards, Washington, DC (USA)). 1980. 7p. Proceedings of International Cryogenic Materials Conference, Madison, WI, August 24-29, 1979, Paper J-5 in Advances in Cryogenic Engineering Materials, 26, p677-683 1980.

A series of NbTi composite rings were constructed in which both the impregnant material and construction technique were varied. Preliminary results indicate that the training of potted superconducting magnets is associated with a process involving relief of stress concentration within epoxy impregnants. The degree of training is correlated with: (1) level of operating current (2) presence of fiberglass in the coil structure (3) prestraining the superconductor prior to winding.

41246 **(PB—81-236598) Turn-on delays in single Josephson junction devices. Final report.** Peterson, R.L. (National Bureau of Standards, Washington, DC (USA)). 1980. 28p. Proceedings of International Conference Superconducting Quantum Devices (2nd), Berlin, Germany, F.R., May 6-9, 1980, Paper in Squid '80, p685-702 1980.

Previous calculations of turn-on delays in circuits containing Josephson junctions have assumed a current stepped up suddenly from the critical value for switching. The more general cases of the current starting below the critical current are examined, as well as ramping through the critical value at a finite rate. Formulas are developed for the ramp-rate dependence of turn-on delay where applicable and establish criteria for determining whether overdrive or ramp rate is the more important.

41247 **(PB—81-808537) Pipeline corrosion. 1964-July 1981 (citations from the NTIS data base). Report for 1964-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 299p. NTIS PC N01/MF N01.

Federally-sponsored research on pipeline corrosion in soils, sea water, and fresh water are covered. Studies include pipeline systems containing natural gas, petroleum, slurries, water, and volatile or corrosive liquids. Materials for pipelines are discussed as well as inhibitors for pipeline systems. Coatings, linings, welding, and testing are described as they relate to corrosion. (This updated bibliography contains 292 citations, 78 of which are new entries to the previous edition.)

41248 **(PB—81-808545) Pipleine corrosion. 1977-July 1981 (citations from the Engineering Index data base). Report for 1977-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 233p. NTIS PC N01/MF N01.

Worldwide research is cited on corrosion and corrosion prevention of pipelines for natural gas, petroleum, water, slurries, and other gases and liquids. Pipes of steel, stainless steel, copper alloys, galvanized steel, concrete, and zinc alloys are the major materials studied. Prevention of corrosion by cathodic protection, coatings, wrappings, and linings are covered. The use of plastics for corrosion resistant pipes is included. (This bibliography contains 245 citations, 9 of which are new entries to the previous edition.)

4203 Lasers

REFER ALSO TO CITATION(S) 41240

41249 **Hypersonic wedge nozzle for chemical lasers.** Hook, D.L.; Waypa, J.; Jacobs, T.A. US Patent Application 220,474. [nd]. Filed date 29 Dec 1980. 10p.

A hypersonic wedge nozzle for chemical lasers that has a radially diverging flow primary nozzle with a multiplicity of hypersonic wedge type secondary injection wedges at the exit end of the primary nozzle to allow gas flow to become supersonic in the primary nozzle before entering the regions between the secondary injection wedges or the surfaces thereof. Utilization of the large diverging primary nozzle in producing supersonic flow minimizes viscous effects in producing the supersonic flow in a chemical HF or DF laser.

41250 **Frequency selectable q-switched laser.** Curtis, R.A.; Webb, W.E. US Patent Application 189,399. [nd]. Filed date 22 Sep 1980. 6p.

A laser is Q-switched through a laser medium, a rotating mirror, one or more apertures and to one or more diffraction gratings. The location of the diffraction gratings being different so as to provide for different pulse intervals and different pre-selected frequencies along the laser axis.

41251 **Heat exchanger base for a portable laser system.** Dawson, S.R.; Hayes, C.L. US Patent Application 210,068. [nd]. Filed date 24 Nov 1980. 7p.

This report describes a rigid, lightweight, base for a portable laser system, the base including a heat exchanger for dissipating heat conducted thereto from the laser system. Heretofore, portable laser systems designed for field use have required massive structural bases to provide the necessary rigidity to maintain the optical alignment of the laser system while in use. Furthermore, high power laser sources required cooling provided by a heat exchanger using water as the thermal transfer medium. The additional weight

caused by the massive structural base and the additional components required by the water coolant heat exchanger greatly reduced the portability of the laser system. To overcome the above-noted problems experienced with portable laser systems, the base of the present invention has been devised to enhance the portability of laser systems and comprises, essentially, a lightweight, low profile, aluminum base having an air coolant heat exchanger contained therein.

41252 **High power nuclear photon pumped laser.** Miller, T.G.; Womack, D.R.; Hagefstration, J.E.; McDaniel, B.G. US Patent Application 213,526. [nd]. Filed date 5 Dec 1980. 8p.

In accordance with this invention, a nuclear source is placed in the center of a cylinder which is made of a material with a large neutron inelastic scattering cross section to convert neutron energy produced by the source to gamma and x-ray energy. Surrounding this scattering material is a cylinder of a moderator which further slows down the neutrons. The moderator cylinder is then surrounded by a further larger cylinder which is filled with a mixture of a photon producing gas. The larger cylinder has several tubes placed therein and sealed relative to the moderator cylinder and the larger cylinder by disk portions at opposite ends. The several tubes contain lasing gas and cavity mirrors for allowing any laser output to be exited therefrom. In this system, neutrons are produced from the source to produce energy which causes photons to be produced from the photon producing gas and these photons pass through the walls of the laser tubes to produce the necessary states required for a population inversion and hence lasing results from the lasing gas within the laser tubes and is output at one end through the cavity mirror of each laser tube.

41253 **High peak power, high prf laser system.** Ward, E.M. US Patent Application 200,664. [nd]. Filed date 27 Oct 1980. 9p.

For many applications of laser techniques, it is often desirable to have a laser device capable of producing output having high peak power, high pulse rate and narrow pulse width. Several techniques have been developed in the art in an effort to attain such output. There are two major difficulties in developing a high peak power, high pulse repetition frequency solid state laser system. Thermal problems are present due to high average powers, and narrow pulse widths are difficult to obtain due to the low gain of a continuous wave pumped oscillator. A technique of the prior art uses an acousto-optic Q-switch which can sustain high average powers. However, such a device produces long pulses widths due to a low gain cavity and slow switching time. Another approach uses electro-optic Q-switches in a pseudo cavity dumping technique which yield narrow pulses and high peak powers at low pulse repetition frequencies. This system, however, becomes unsatble due to thermal induced birefringence when the high average powers of high pulse repetition frequencies are encountered. Accordingly, it is an object of this invention to provide a laser system which overcomes the above noted disadvantages inherent in the devices of the prior art.

41254 **(AD-A—097754/6) Research and development of advanced design injection laser diodes. Final technical report, September 1978-September 1980.** Stockton, T.E.; Speer, F.D. (Laser Diode Labs., Inc., Metuchen, NJ (USA)). 30 Sep 1980. 56p. NTIS PC A04/MF A01.

High peak power, pulsed GaInAsP/InP Large Optical Cavity (LOC) injection lasers emitting in the 1.0 to 1.3 micron region have been developed and studied under this program. This final report describes efforts directed toward the optimization of these devices and, in particular, concentrates on the following points: (1) Materials and structure development required to extend wavelength and peak power capability. (2) Process development connected with the fabrication of high power stripe geometry long wavelength lasers. (3) Package development and fiber coupling techniques for these devices. Excellent peak power performance, on the order of 4 mW per micron of junction length, was obtained for quaternary LOC laser diodes at a peak wavelength of 1.16 microns. In addition, greater than 25% coupling efficiency was demonstrated for 3 mil stripe quaternary LOC lasers coupled to 55 micron core graded index fiber. Peak optical power in excess of 75 mW was routinely obtained from the fiber pigtail. These devices are extremely well suited as sources for long haul, low bandwidth digital fiber optic systems where their high peak power capability can compensate for fiber darkening in high level radiation environments.

41255 **(AD-A—097832/0) Bibliography of Soviet laser developments, number 46, March - April 1980.** (Defense Intelligence Agency, Washington, DC (USA). Directorate for Scientific and Technical Intelligence). 5 Feb 1981. 151p. (DIA-DST—2700Z-001-81). NTIS PC A08/MF A01.

This is the Soviet Laser Bibliography for March-April 1980, and is No. 46 in a continuing series on Soviet laser developments. The coverage includes basic research on solid state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; crystal growing; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; beam propagation; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser measurement applications; laser-excited optical effects; laser spectroscopy; beam-target interaction; and plasma generation and diagnostics.

41256 **(AD-A—097862/7) Amplification in double heterostructure GaAs lasers. Interim report.** Garmire, E.; Chang, M. (Aerospace Corp., Los Angeles, CA (USA). Electronics Research Lab.). 15 Mar 1981. 46p. NTIS PC A03/MF A01.

Regenerative amplification has been measured in a DH GaAs laser in two different geometries, including both discrete and integrated optics configurations. Regimes of strong and weak signal gains have been identified and measured, with gains being as large as 170. Comparison has been made between the experimental results and theoretical models. In general, the agreement is excellent. Details of the experiments and theoretical models are presented in this report.

41257 **(AD-A—097899/9) Progress toward a monolithically integrated coherent diode laser array. Interim report.** Evans, G.A.; Garmire, E.M.; Stoll, H.M.; Osmer, J.A.; Soady, W.E. (Aerospace Corp., Los Angeles, CA (USA). Electronics Research Lab.). 20 Feb 1981. 210p. NTIS PC A10/MF A01.

Progress toward the design and fabrication of a GaAlAs semiconductor laser array capable of high average power levels (0.1 to 1.0 watt) and low (approx 1 millirad) beam divergence is reported. A large optical cavity (LOC) configuration is grown by liquid phase epitaxy. The LOC structure is characterized by photoluminescence scans, ion microprobe mass analysis (IMMA), and optical waveguiding measurements. Fabry-Perot, active-passive, and DBR lasers are fabricated using chemical and ion beam etching. Gratings formed using holographic and ion beam etching techniques provide third order feedback for the DBR lasers, and are also used as distributed beam deflectors (DBDs) and output couplers. Comparisons of the results of experiments performed on DBR lasers, DBDs, and coupled lasers are made with theoretical models. Details of the material growth, material characterization, device fabrication, experiments, and theoretical models are presented in this report.

41258 **(AD-A—097978/1) Studies of beam expansion and distributed Bragg reflector lasers for fiber optics and optical signal processing. Interim report.** Garmire, E.M. (Aerospace Corp., Los Angeles, CA (USA). Electronics Research Lab.). 3 Mar 1981. 51p. NTIS PC A04/MF A01.

Separate studies were performed on beam expansion and on Distributed Bragg Reflector (DBR) lasers preliminary to monolithic integration on GaAs substrates. These components are proposed for use in optical signal processing, for fiber optic sources and for high-brightness lasers.

41259 **(AD-A—097979/9) Summary of the Aerospace Corporation chemical laser program, 1968 - 1980. Interim report.** Warren, W.R. Jr. (Aerospace Corp., El Segundo, CA (USA). Aerophysics Lab.). Apr 1980. 60p. NTIS PC A04/MF A01.

The applied research work since 1968 of Aerophysics Laboratory personnel in high-energy laser-related technology areas is summarized. The results are primarily concerned with hydrogen halide chemical lasers. The eight principal technology areas identified are hydrogen halide laser devices, hydrogen halide chemical kinetics (neutrals), pulsed hydrogen fluoride, HF (and deuterium fluoride, DF) lasers, fluid dynamics – CW HF (DF) supersonic diffusion lasers, laser device optics, short wavelength lasers, diagnostics - instrumentation/test techniques, and special studies; several subdivisions are given for each area. A comprehensive Bibliography and a list of laser related inventions are presented; these are cross-referenced to the technology areas and their subdivisions. The experimental and computer capabilities of the Laboratory are described briefly.

41260 **(AD-A—098080/5) A numerical study of the nanosecond and subnanosecond performance of Gekko XII-Module. Memorandum report.** Lehmberg, R.H.; McMahon, J.M. (Naval Research Lab., Washington, DC (USA)). 23 Apr 1981. 29p. (NRL-MR—4493). NTIS PC A03/MF A01.

A numerical study is conducted to examine the performance potential of the GEKKO XII-Module, a phosphate glass laser system currently under development at Osaka University. The study shows that with appropriate modifications, this system should produce peak powers up to 3.6 TW/beam in a 50 psec pulse, and 2-2.5 kJ/beam in a 1 nsec pulse. The similarity between the GEKKO XII-Module and Shiva beam line configurations suggests that a phosphate glass retrofit of Shiva could produce nanosecond pulse energies up to 50kJ.

41261 **(AD-A—098241/3) Free electron laser instability for a relativistic annular electron beam in a helical wiggler field. Technical report.** Uhm, H.S.; Davidson, R.C. (Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.). Nov 1980. 42p. (SAI—254-80-626-LJ; PRI—17). NTIS PC A03/MF A01.

The free electron laser instability is investigated for a relativistic annular electron beam propagating through a helical wiggler magnetic field. It is assumed that the beam is thin, with radial thickness (2a) much smaller than the beam radius (RO), and that nu/gamma(b) << 1, where nu is Budker's parameter. The stability analysis is carried out within the framework of the linearized Vlasov-Maxwell equations for perturbations with general azimuthal harmonic number l and radial mode number s, including the important influence of (a) finite beam geometry in the radial direction, (b) positioning of the beam radius relative to the outer conducting wall (RO/Rc), and (c) finite wiggler amplitude (deta B). All of these effects are shown to have an important influence on stability behavior. Moreover, the maximum coupling between the transverse and longitudinal modes increases substantially with increasing radial mode number s. It is also found that the transverse magnetic (TM) mode has slightly larger growth rate than the transverse electric (TE) mode.

41262 **(AD-A—102882/8) FY 1980 report on dye laser materials. Research report October 1979-September 1980.** Fletcher, A.N. (Naval Weapons Center, China Lake, CA (USA)). Feb 1981. 26p. (NWC-TP—6256). NTIS, PC A03/MF A01.

Ten commercially available rhodamine dyes have been examined for their stability in dye lasers. Except for rhodamine 101 and sulforhodamine 101, the output of the dye laser showed a time dependence in addition to the dependence upon total input energy per unit volume; i.e., these latter dyes showed a 'recovery' in laser output upon standing overnight. Unfortunately, the recovered solution shows a faster decay than would the original dye solution. Sulforhodamine 101 showed the highest dye laser lifetime parameters, followed by rhodamine 3B. Little difference was observed in the lifetime of the remaining dyes. The unsubstituted amines showed the lowest lasing outputs, highest laser thresholds, and the bluest laser emission of the ten dyes.

41263 **(AD-A—103049/3) Low voltage free electron laser. Volume II. Theory. Final report 30 April 1980-29 April 1981.** Mani, S.A.; Chang, C.S. (Schafer (W.J.) Associates, Inc., Wakefield, MA (USA)). 29 Jun 1981. 49p. NTIS, PC A03/MF A01.

The theory of the low voltage free electron laser has been surveyed. The physics of trapping and high extraction are discussed. The technical issues connected with the two stage FEL optics are discussed.

41264 **(AD-A—103066/7) Stability of a normal shock in radial reacting flow with nonuniformities. Technical report.** Durran, D.A.; Epstein, M.; Warren, W.R. Jr. (Aerospace Corp., El Segundo, CA (USA). Aerophysics Lab.). 15 Jun 1981. 59p. NTIS, PC A04/MF A01.

Pressure recovery for a cylindrical chemical laser is optimized when a normal shock is located just outside the optical cavity region. The feasibility of maintaining a shock in such a position when the radial flow is reacting and contains nonuniformities has been demonstrated in a small-scale experiment. Flow visualization and flow diagnostics have verified that the shock is stable and that its position is readily adjusted by changing the downstream pressure. Although actual pressure recovery was not measured, it is expected that 100% of normal shock pressure recovery can be achieved in full-scale laser systems without the need for a supersonic diffuser.

41265 **(AD-A—103730/8) Mercury bromide laser research. Final report 1 Jul 80-31 Mar 81.** Pack, J.L.; Liu, C.S.; Feldman, D.W.; Liberman, I. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 4 May 1981. Contract N00014-80-C-0604. 61p. NTIS, PC A04/MF A01.

This report summarizes major effort to build a discharge tube and associated apparatus capable of withstanding temperatures to 300 C and pressure to 150 psia, and to parameterize the HgBr laser fluorescence and laser output with respect to nitrogen and Ne buffer gas densities. Prior parameterization has been limited to buffer gas densities of about 1.3 Amagat since the laser tube was made Pyrex and therefore could not sustain more than about 15 psi internal over pressure. By enclosing the Pyrex laser tube inside a stainless steel pressure vessel, we have overcome this pressure limitation by maintaining a positive external pressure upon the laser tube. The steel tank was pressurized with nitrogen to avoid oxidation of the tube connections. Thus, the discharge tube, by being enclosed in a nitrogen protective atmosphere, withstands both the high temperature operation and the high internal operating pressures. Fluorescence, laser output, voltage and current waveforms were taken at various nitrogen fill pressures up to 300 Torr with Ne buffer gas densities up to 5 Amagat. For our experimental tube, the HgBr laser output and fluorescence efficiency was maximum at a nitrogen fill pressure of 150 Torr and increased with neon buffer gas density up to the maximum tested of 5 Amagat at a reservoir temperature of about 150 C.

41266 **(AD-A—103835/5) Source flow effect on lineshape. Technical report.** Mirels, H. (Aerospace Corp., El Segundo, CA (USA). Aerophysics Lab.). 10 Jul 1981. Contract F04701-80-C-0081,. 19p. NTIS, PC A02/MF A01.

The effect of particle motion on spectral lineshape (i.e., Doppler broadening) is usually evaluated by assuming that the particles have a random thermal motion. In high-speed gas-flow lasers, of which chemical lasers are an example, the working fluid may have significant mean velocities as well as random velocities in the optical path direction. In these cases, it is necessary to take the mean motion into account when evaluating the spectral lineshape. The effect of a source flow on Doppler-broadened lineshape is evaluated herein for the case where radiation is perpendicular to the source flow axis. The application to a cw chemical laser is then noted.

41267 **(PB—81-137895) Direct frequency measurement of the 260 THz (1.15 micrometers) (20)Ne laser: and beyond.** Jennings, D.A.; Petersen, F.R.; Evenson, K.M. (National Bureau of Standards, Washington, DC (USA)). 1979. 8p. (CONF-790690—). NTIS, PC A02/MF A01.

From 4. international conference on laser spectroscopy; Rottach-Egern, Tegernsee, F.R. Germany (11 Jun 1979).

Absolute frequency measurement has been extended to the visible spectrum with the measurement of the strong 1.15 microme-

ters laser line in (20)Ne at 260 THz and lines in iodine at twice this frequency. The 260 THz frequency was synthesized in nonlinear crystals of $CdGeAs_2$ and $AgAsS_3$ from stabilized CO_2 lasers and the 1.5 micrometers laser line in (20)Ne. The visible frequencies were synthesized by generating the second harmonic of the 260 THz radiation with a $LiNbO_3$ crystal. The absolute frequencies of ten hyperfine components of $(127)I_2$ near 520 THz were measured.

41268 **(PB—81-236192) System for characterizing detectors for measurement of power of CO_2 tea laser pulses. Final report.** Simpson, P.A. (National Bureau of Standards, Washington, DC (USA)). 1979. 9p. Proceedings of the Electro-Optics/Laser 79 Conference and Exposition (11th) held at Anaheim, CA, on October 23-24, 1979, p399-407 1979.

A system for characterizing detectors for the measurement of power of CO2 laser pulses in the range of 10 kW up to 1 to 2 MW with a time resolution of several nanoseconds has been developed at the Boulder Laboratories of the National Bureau of Standards. This system measures the responsivity of the detectors. The dependence of responsivity on power density and optical signal risetime is studied. The basic principles involved are discussed, and the results of measurements on some detectors are presented.

41269 **(PB—81-857039) Ultraviolet lasers. January 1970-December 1980 (citations from the Engineering Index Data Base). Report for January 1970-December 1980.** (New England Research Application Center, Storrs, CT (USA)). Jan 1981. 91p. NTIS PC N01/MF N01.

The citations in this bibliography cover repetitive, turnable, high-power vacuum ultraviolet lasers, special application coatings and methods of efficient generation for ultraviolet radiation and lasers, long pulse ultraviolet laser emissions, spectral characteristics of vacuum ultraviolet preionizationsources for CO2 lasers, experimental investigations of aero-acoustic effects in large-volume ultraviolet laser discharges, and ultraviolet laser performance and spectroscopy. (Contains 95 citations, fully indexed and including a table of contents.)

41270 **(UCRL—87232) Halide laser glasses.** Weber, M.J. (SEE CODE- 9513035 California Univ., Livermore (USA). Lawrence Livermore National Lab.). 14 Jan 1982. Contract W-7405-ENG-48. 6p. (CONF-820339—1). NTIS, PC A02/MF A01. Order Number DE82008997.

From 1. international symposium on halide and other non-oxide glasses; Cambridge, UK (1 Mar 1982).

Energy storage and energy extraction are of prime importance for efficient laser action and are affected by the line strengths and linewidths of optical transitions, excited-state lifetimes, nonradiative decay processes, spectroscopic inhomogeneities, nonlinear refractive index, and damage threshold. These properties are all host dependent. To illustrate this, the spectroscopic properties of Nd^{3+} have been measured in numerous oxide, oxyhalide, and halide glasses. A table summarizes the reported ranges of stimulated emission cross sections, peak wavelengths, linewidths, and radiative lifetimes associated with the ^{4}F/sub 3/2/ $\rightarrow$ ^{4}I/sub 11/2/ lasing transition.

41271 **Laser parameters in a high repetition rate XeCl minilaser.** Sze, R.C.; Seegmiller, E. pp 659-663 of Proceedings of the international conferences on lasers '80, December 15-19, 190. Los Alamos, NM; Los Alamos Scientific Laboratory (1980).

Gain and saturation intensity parameters are obtained for a high repetition rate miniature rare-gas halide laser. Net small signal gains as high as 0.3 cm^{-1} in XeCl are obtained 9 figures.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 41002

41272 **Horizontal two-phase flow of gases and non-Newtonian liquids.** Shu, M.T. Philadelphia, PA; Drexel Univ. (1981). 286p. University Microfilms Order No. 82-04,172.

Thesis (Ph. D.).

The goal of the research reported here is to develop methods whereby pressure drop, void fraction, and flow pattern for horizontal two-phase flow of gases and non-Newtonian liquids can be predicted simply from knowledge of fluid properties, flow rates, and pipe size. The scope of investigation includes experimental work on two-phase flow patterns of annular, intermittent, and stratified flow, as well as the transitions among these patterns. Experimental tests have been performed using sevarl Newtonian and pseudoplastic liquids to cover a wide range of viscosity and pseudoplasticity. The experimental work has also been complemented by the development of analytical models for each flow pattern, in which predictive equations account quantitatively for the shear-dependent viscosity of the liquid phase. For pressure drop and holdup, models obtained by modifying existing correlations for Newtonian liquids yield good agreement between theory and experiment for annular flow and for stratified wavy flow. Pseudoplasticity of the liquid, entrainment of liquid droplets in the gas, and aeration of dispersed bubbles in the liquid are predicted to reduce both pressure drop and holdup significantly and experimental results tend to confirm these trends. Pseudoplasticity also affect flow pattern transition. In particular, shear-thinning increases the void fraction of the two-phase mixture and thus causes the transition to annular flow to occur at higher gas velocities than for Newtonian liquids of comparable zero-shear viscosity. This effect can be predicted from a correlation developed in this work. Another feature of this study is the experimental development of a capacitance sensor for void fraction measurement of two-phase flow in cylindrical channels. Theoretical prediction of the device's behavior is also presented.

41273 **Further compilation of compressible boundary-layer data with a survey of turbulence data.** Fernholz, H.H.; Finley, P.J.; Mikulla, V. Neuilly-sur-Seine, France; Advisory Group for Aerospace Research and Development (1981). 222p. (AGARD-AG—263). National Technical Information Service (NTIS), 5285 Port Royal Rd., Springfield, VA 22161.

Portions of document are illegible.

This volume is a continuation of AGARDographs 223 and 253. The data compilation for 59 nominally two-dimensional compressible shock-free flows presented in AGARDograph 223 is supplemented by a further 18 cases, including some shock-boundary-layer-interactions. The data are also available on magnetic tape from AGARD centers as for AGARDograph 223. The text preceding the compilation gives a review of the available turbulence measurements. The measurements are compared on the basis of inner and outer region similarity relationships. There is little evidence of any quantitative correlation between different experiments. There is also an examination of the breakdown conditions for the Van-Driest/Crocco meanflow temperature-velocity correlation and the associated transformation procedures. The effects of extreme transverse curvature on the mean flow are briefly considered.

41274 **Compilation of unsteady turbulent boundary-layer experimental data.** Carr, L.W. Neuilly-sur-Seine, France; Advisory Group for Aerospace Research and Development (1981). 56p. (AGARD-AG—265). National Technical Information Service (NTIS), 5285 Port Royal Rd., Springfield, VA 22161.

A comprehensive literature search was conducted and those experiments related to unsteady turbulent boundary-layer behavior were cataloged. In addition, an international survey of industrial, university, and governmental research laboratories was made, in which new and ongoing experimental programs associated with unsteady turbulent boundary-layer research were identified. Pertinent references were reviewed and classified based on the technical emphasis of the various experiments. Experiments that include instantaneous or ensemble-averaged profiles of boundary-layer variables are stressed. Detailed reviews that include descriptions of the experimental apparatus, flow conditions, summaries of acquired data, and significant conclusions are made. The measurements made in these experiments that exist in digital form have been stored on magnetic tape, and instructions are presented for accessing these data sets for further analysis.

4205 Materials Testing

REFER ALSO TO CITATION(S) 40720, 41300

41275 **(PNL-SA—10025) Ultrasonic angle beam profiling in steel using an EMAT receiver.** Becker, F.L.; Busse, L.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1982. Contract AC06-76RL01830. 7p. (CONF-820332—1). NTIS, PC A02/MF A01. Order Number DE82008579.

From Spring ASNT conference; Boston, MA, USA (1 Mar 1982).

A system for measuring the beam profile of angle beam search units in steel is described. This technique employs an electromagnetic acoustic transducer (EMAT). The EMAT is sensitive to shear waves polarized parallel to the surface and requires no couplant. A steel block with surfaces cut at angles normal to the ultrasonic beam propagation direction is used. The amplitude distribution of the angle beam is measured at the surface of the test block using the EMAT receiver. The information is recorded using a programmable desk top calculator. The calculator then provides a cross sectional beam plot (normal to propagation direction) as well as vertical and horizontal amplitude traces for beam spread measurements.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 41157

41276 **(BMFT-FB-T—80-087) High energy electron irradiation to adjust minority carrier lifetimes in production. Final report.** Eichinger, P.; Weidhaas, J. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Muenchen (Germany, F.R.)). Nov 1980. 33p. NTIS PC A03/MF A01.

Different types of thyristors, triacs and diodes were irradiated with high energy electrons from a Van de Graaf accelerator. Electron irradiation leads to a better reproductibility and a higher degree of homogeneity for minority carrier lifetimes than gold diffusion techniques. The lateral spread in lifetimes after local irradiation through masks was investigated. The results show a significant lateral spread in the lifetime profile specially for high electron energies and doses (energy range 1 to 2.5 Mev, dose range 10 to the 13 power to 10 to the 16 power electrons/cm squared). The results demonstrate the suitability of this technique.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 41015, 41129

41277 **(PB—82-106121) Comparative study of air classifiers. Final report.** Hopkins, V.; Simister, B.W.; Savage, G.M. (Midwest Research Inst., Kansas City, MO (USA)). Sep 1981. Contract EPA-68-03-2730. 294p. NTIS, PC A13/MF A01.

This report describes the results of field tests of seven different air classifier systems. The systems are compared in regard to (a) their capacity to handle refuse and separate it into a heavy fraction and a light fuel fraction, (b) their ability to concentrate lights in the light fraction and heavies in the heavies fraction as compared to the infeed, (c) the quality of the light fraction for refuse-derived fuel, (d) the yield of combustibles from the infeed that are collected in the light fraction, (e) the consumption of air required to handle a given quantity of infeed, and (f) costs (engineering, capital, and operation and maintenance) per unit weight of refuse infeed at design capacity. Tests were run on each classifier at three airflow rates and at 5 to 10 refuse infeed rates. Procedures used to run these tests are given, and treatment of samples taken from light and heavy fraction streams is outlined. Each air classifier system is described, operation explained, and conclusions and recommendations enumerated.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 40157, 40180, 40187, 40248

41278 (CONF-811061—, pp VI.1-VI-10) **Technology for ceramic tube heat exchangers.** Ward, M.E.; Solomon, N.G. (Solar Turbines International (STI), San Diego, CA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

Present gas turbines must operate with high grade fuels to avoid damage when the combustion gases are expanded through the turbine: Low grade fuels including coal can be used if the turbine is fired indirectly by the transfer of heat from the combustion gases to the compressor air by means of a heat exchanger. The new, silicon-base ceramics appear to be the only materials able to provide the strength at temperature, erosion and corrosion resistance and thermal shock resistance required in the tubes of this heat exchanger. The present program is an extension resulting from the successful operation of a full size ceramic heat exchanger above 1150°C (2100°F) outlet temperatures at 689 kPa (100 psi) with firing temperatures at 1370°C (2500°F). The present project encompasses component thermal shock and strength testing, joining technology development, finite element analysis of the ceramic tubular header, endurance testing of the full size ceramic heat exchanger and firing this heat exchanger with a STI pulverized coal burner.

41279 **(EUR—7191-EN) Determination of the design parameters for a combustion control system for industrial package boilers using the flame-radiation peak-seeking technique. Final report.** Naghten, P.J.; Harfoot, J.M. (Land Pyrometers Ltd., Sheffield (UK); Institute for Industrial Research and Standards, Dublin (Ireland)). 1981. 32p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

Work carried out to investigate the parameters affecting the development of a combustion control system for industrial package type shell boilers is described. The method of control is based on the technique of flame radiation peak seeking. Some experimental work with a protoype of the control system is also described.

41280 **(PB—82-115486) Industrial burner and process efficiency program. Annual report Jan-Dec 80.** Huebner, S.R.; Prakash, S.N. (Midland-Ross Corp., Toledo, OH (USA). Technical Center - Thermal Systems). Mar 1981. Contract GRI-5011-342-0148. 96p. NTIS, PC A05/MF A01.

A laboratory prototype burner which is compatible with a FM (Frequency Modulation) combustion control system where temperature control is accomplished by regulating the ratio of burner on-time to burner off-time has been developed. This multi-fuel (Natural Gas and No. 2 Fuel Oil) high velocity burner is capable of repeated pulse ignition at maximum rated capacity (1 million Btu/hour) with preheated air (from ambient to 1100F). Compared to a convention AM (Amplitude Modulation) combustion system, this burner offers the potential for considerably higher convective heat transfer rates during reduced heat demand (turndown) conditions. A digital control system for furnace temperature control in the FM mode has been developed. Experimental data from tests in a laboratory furnace has indicated that when applied to a batch type thermal process where appreciable turndown is presently obtained by excess air operation, the FM combustion system provides improvements in process fuel efficiency and gains in productivity. The FM combustion system will next be tested under industrial production conditions to establish the actual fuel savings, productivity gains and application economics.

41281 **(ANL/CEN/FE—80-15-Suppl.) Instrumentation information: data sheets on FBC instrumentation needs reported to the Argonne National Laboratory survey, grouped according to measurement category.** (Argonne National Lab., IL (USA)). [nd]. Contract W-31-109-ENG-38. 282p. NTIS, PC A13/MF A01. Order Number DE82011858.

A study was conducted to evaluate the current state of the art of instrumentation for planned and operating fluidized-bed combustion systems. This study is intended to identify instrumentation needs and serve as a data base for projects to develop this instrumentation. A considerable number of needs for measurements for which presently available instrumentation is not suitable have been reported by respondents. The identified deficiencies are presented with the associated physical parameter ranges for FBC processes. New techniques and instrumentation under development, as well as some available alternative instruments, are discussed briefly. Also, newly instituted mechanisms for technical information exchange on instrumentation for fossil energy applications are identified. Continuing development of instruments to meet the identified measurement deficiencies is recommended. Data sheets are presented that contain information on solids mass flow, exhaust gas flow, entrained solids, composition of solids, elements in gas streams, molecular composition of gas streams, fluidized bed levels and densities, combustor temperatures, and vessel wall temperatures.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 40151, 40152, 41070

41282 **(GAT-S—24) Corrosion in coal-fired boilers.** Vausher, A.L. (Goodyear Atomic Corp., Piketon, OH (USA)). 1982. Contract AC05-76OR00001. 18p. (CONF-820418—7). NTIS, PC A02/MF A01. Order Number DE82011811.

From UCC-ND and GAT environmental protection seminar; Gatlinburg, TN, USA (5 Apr 1982).

The corrosive effect of the flue gas and the fly ash from burning coal on combustion and pollution control equipment has led to extensive research efforts aimed at solving this problem. A wide variety of chemical additives are offered by suppliers to perform corrosion reduction functions when added to the solid or liquid fuel. Protection of equipment by the use of corrosion resistant coatings and improved designs to prevent or reduce slag formation are also well known corrosion reduction techniques. However, the problem facing management is to evaluate the many different alternatives and to define the most effective one for their particular facility. Information gained from previous corrosion reduction attempts, and knowledge of factors which increase the SO_3/SO_2 ratio in the flue gas have resulted in the investigation of methods of controlling the dew point and therefore, reducing the condensation of sulfuric acid. Various methods of avoiding the formation of acid are being evaluated.

4250 Power Cycles

41283 (CONF-811061—, pp VI.20-VI.26) **High-temperature ceramic heat exchanger.** Coombs, M.G.; Kotchick, D.M. (Airesearch Manufacturing Co., Torrance, CA). 1981. NTIS, PC A24/MF A01.

From 6. annual conference on materials for coal conversion and utilization; Gaithersburg, MD, USA (13 Oct 1981).

The heat exchanger design for the closed-Brayton-cycle engine consists of an assembly of six heat exchanger modules coupled with V-band clamps. Each module consists of 30 ceramic finned U-tubes bonded to inlet and exit manifold sections. The ceramic material is siliconized silicon carbide (Norton NC-430). The hot gas is confined to the finned portion of the heat exchanger by a series of ceramic flow-diverter plates. Using NC-430 Norton demonstrated significant processing advances including fabrication of complex shapes and limited-size ceramic-to-ceramic permanent joints with strength nearly equivalent to the parent material. A finned, 10-tube heat exchanger module embodying many of the characteristics of the full-scale module is shown. The module has 40 permanent joints bonding 2 separately fabricated manifolds, 20 finned tubes, and 10 U-tubes. The basic materials tests were conducted on specimens of NC-430 and SASC with as-fired surfaces to simulate the as-fabricated heat exchanger material properties. The tests added significantly to the data base for both materials, providing useful information on operating temperature and environment, Weibull parameters, flexural and stress rupture strength, and cyclic fatigue. Components were subjected to flexural strength and burst tests at room and high temperature. The strength of these complex components was significantly lower than predicted from bar specimen tests; it has not been established if the reduction in strength is due to differences in processing or to residual stresses produced during fabrication. A special technique was developed to analyze ceramic structural assemblies.

41284 **(ORNL/TM—8022) Stirling engine with one adiabatic cylinder.** West, C.D. (Oak Ridge National Lab., TN (USA)). Mar 1982. Contract W-7405-ENG-26. 57p. NTIS, PC A04/MF A01. Order Number DE82009606.

It is shown that integration around the P-V loop of a Stirling-like cycle with an adiabatic expansion or compression space is possible through careful application of the ideal gas laws. The result is a set of closed-form solutions for the work output, work input, and efficiency for ideal gases. Previous analyses have yielded closed-form solutions only for machines in which all spaces behave isothermally, or that have other limitations that simplify the arithmetic but omit important aspects of real machines. The results of this analysis, although still far removed from the exact behavior of real, practical engines, yield important insights into the effects observed in computer models and experimental machines. These results are especially illuminating for machines intended to operate with fairly small temperature differences. Heat pumps and low-technology solar-powered engines might be included in this category.

41285 **Solid state engine using Nitinol memory alloy.** Golestaneh, A.A. (to Department of Energy). US Patent 4,302,939. 1 Dec 1981. Filed date 21 Jan 1980. vp.

PAT-APPL-114134.

A device for converting heat energy to mechanical energy includes a reservoir of a hot fluid and a rotor assembly mounted thereabove so a portion of it dips into the hot fluid. The rotor assembly may include a shaft having four spokes extending radially outwardly therefrom at right angles to each other, a floating ring and four flexible elements composed of a thermal memory material having a critical temperature between the temperature of the hot fluid and that of the ambient atmosphere extending between the ends of the spokes and the floating ring. Preferably, the flexible elements are attached to the floating ring through curved leaf springs. Energetic shape recovery of the flexible elements in the hot fluid causes the rotor assembly to rotate.

41286 **Overview of DOE's large stationary Stirling engine development program.** Uherka, K.L. (Argonne National Laboratory, Argonne, IL); Holtz, R.E. (U.S. Department of Energy, Washington, DC). pp 1847-1853 of Proceedings of 16th intersociety energy conversion engineering conference, Atlanta, GA, August 9-14, 1981. Volume 2. New York, NY; American Society of Mechanical Engineers (1981).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

This paper summarizes the results to date of a program, sponsored by DOE's Office of Fossil Energy, to develop large stationary Stirling engine power systems. Primary applications for such power plants include cogeneration and total energy systems, with a major advantage being their ability to employ solid coal and other non-scarce fuels in an environmentally acceptable manner. The major effort in the Stirling engine development program was an industry-based design competition, involving three independent contractual teams. Conceptual designs for state-of-the-art coal-fired Stirling engine systems were developed and all three design teams recommended development of 373 kW modules as base units, which can be coupled together to form individual Stirling engines up to 2238 kW in size. Heat transport system design concepts were also developed for integrating engine hot-end sections with coal combustors.

41287 **Experimental measurements of enhanced heat transfer in a Stirling engine model with interleaving fins.** Hauser, S.G. (Battelle Pacific Northwest Laboratories, Richland, WA); Martini, W.R. (Battelle Pacific Northwest Laboratories; Martini Engineering, Richland, WA); Scheffler, W.A. (Battelle Pacific Northwest Laboratories; Joint Center for Graduate Study, Richland, WA). pp 1925-1928 of Proceedings of 16th intersociety energy conversion engineering conference, Atlanta, GA, August 9-14, 1981. Volume 2. New York, NY; American Society of Mechanical Engineers (1981).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

An apparatus was designed and constructed to measure the transient cooling effects on a gas inside a closed space. Modeled after a type of Stirling engine, the closed space was built with a cylinder and a displacer which divided the gas space into a hot space, a cold space, and a regenerator space. The cold space consisted simply of gas between two flat plates while the hot space was divided into very thin gas layers by using interleaving fins. A pressure transient was measured both while the gas was being cooled in the cold space and heated in the hot space. A method was developed to calculate the heat transfer coefficient in each closed space from the measured pressure transient. Several tests were done and the data shown. Heat transfer coefficients for each test were calculated and correlated in the form of Nu versus Re. The data show the quantitative increase in heat transfer due to the interleaving fins.

41288 **Comparative analysis of computer codes for Stirling engine cycles.** Ash, J.E.; Heames, T.J. (Argonne National Laboratory, Argonne, IL). pp 1936-1941 of Proceedings of 16th intersociety energy conversion engineering conference, Atlanta, GA, August 9-14, 1981. Volume 2. New York, NY; American Society of Mechanical Engineers (1981).

From IECEC conference; Atlanta, GA, USA (9 Aug 1981).

43 PARTICLE ACCELERATORS

REFER ALSO TO CITATION(S) 41847

4301 Design, Development, And Operation

41289 **(AD-A—102874/5) Collective ion acceleration and electron beam propagation in dielectric guides. Final report 1 February 1979-31 January 1981.** Halverson, W.D. (Spire Corp., Bedford, MA (USA)). 1 May 1981. 59p. (FR—10067). NTIS, PC A04/MF A01.

The propagation of electron beam currents much greater than the space charge limit and collective ion acceleration in evacuated dielectric guides was investigated. Experiments at Spire and at the Gamble I facility of NRL show that the beam front propagation velocity is not affected by the dielectric guide downstream from the anode region of the accelerator. The propagated current, however, depends strongly on guide parameters, and is considerably diminished in a shortened guide configuration. Collectively accelerated ions were not observed using the 40 ns, 200 keV electron accelerator at Spire, although earlier experiments using longer, lower energy pulses showed considerable ion acceleration. Proton energies more than 14 times the electron beam energy were observed during the experiment on Gamble I. An estimated 2x(10 to the 9th power) protons at 12 MeV or greater along with 3x(10 to the 11th power) protons at 5 MeV or greater were observed in a single shot. The origin of the collectively accelerated protons was principally in the anode foil of the accelerator. Suggestions for increasing the energy and yield of collectively accelerated ions include improving the homogeneity of the downstream plasma and reducing the magnetic field of the propagating electron beam current.

41290 **(PB—81-240236) Cw electron accelerators for nuclear physics. Final report.** Penner, S. (National Bureau of Standards, Washington, DC (USA)). 1981. 7p. Proceedings of Particle Accelerator Conference (1981), Accelerator Engineering and Technology, Washington, DC, March 11-13, 1981, IEEE Transactions on Nuclear Science, NS-28, n3 p2067-2073 June 1981.

The need for continuous duty electron accelerators for nuclear physics research is discussed. The various types of accelerators capable of satisfying the physics requirements are described and compared.

41291 **(PB—81-241275) Recirculation acceleration of high current relativistic electron beams--a feasibility study. Final report.** Wilson, M. (National Bureau of Standards, Washington, DC (USA)). Jun 1981. 3p. Proceedings of Particle Accelerator Conference (1981), Accelerator Engineering and Technology, Washington, DC, March 11-13, 1981, IEEE Transactions on Nuclear Science NS-28, n3 p3375-3377 June 1981.

One of the advanced accelerator concepts under study at NBS involves multiplying the energy gained by a long-pulse, high current relativistic electron beam by directing the beam several times through the same induction accelerator during the time of one voltage pulse. Should this concept of the recirculation acceleration of intense electron beams be proven feasible, the savings in cost, size, and weight of a high current accelerator would be considerable. Energy gain by recirculation acceleration through a small-scale proof-of principle facility has been demonstrated at NBS. The study employs a 750A, 750keV electron beam pulse, 2 microsec long, generated by a linear induction accelerator of unique design which was also developed at NBS.

41292 **MPD intense beam pulser.** Turchi, P.J.; Virkovitsky, I.M. US Patent Application 6,285,690. 21 Jul 1981. 36p.

An MPD intense beam pulser for generating high voltage, intense charged particle beams utilizing an electromechanical energy source and inductive energy storage in combination with a plasma opening switch including a source of directed plasma flow, a diode for accelerating particles in the plasma flowing from the source, and a plasma flow truncation circuit. In operation, a controlled plasma flow is used to conduct current from the energy source in order to supply a desired amount of energy to the magnetic field in the volume surrounding the plasma flow. Truncation of the plasma flow between the electrodes forming the diode then provides a high voltage in a short pulse which generates a high energy charged particle beam. Thus, the magnetic energy store surrounding the diode plasma flow is coupled directly to the intense particle beam.

41293 **Inductive intense beam source.** Turchi, P.J.; Vitkovitsky, I.M. US Patent Application 6,258,661. 21 Jul 1981. 24p.

This document describes an inductive intense beam source utilizing a plurality of fuses (or a cylindrical foil) surrounding a plasma column. The fuses (or foil) carry a current and thus establish an inductive energy storage volume therearound which is segregated from the plasma column. When the fuses or foil are vaporized, the energy stored therearound is converted to kinetic energy in the form of an accelerated particle beam.

4302 Beam Dynamics, Field Calculations, And Ion Optics

41294 (KFTI—81-8, pp 56-57) **Theory of transverse instability in mean energy electron linacs.** Aizatskii, N.I. 1981. (In Russian). NTIS (US Sales Only), PC A04/MF A01.

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1981).

The methods and results of theoretical investigation of transverse beam instability in resonance linacs with a relatively small number (<10) of accelerating units are discussed. Using the method of mathematical simulation of the process of excitation of axially

nonsymmetric oscillations in a separate accelerating unit the critical currents of the LUEh-300 accelerator of the KFTI under the Ukrainian Academy of Sciences for several modernization versions of the accelerating structure are calculated. The possibility of increasing the critical pulsed currents by replacing a part of standard units by the modernized ones.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 41887

41295 (CERN—81-09, pp 709-710) **On-line separation of refractory hafnium and tantalum isotopes at the ISOCELE separator.** Liang, C.F.; Paris, P.; Bastin, G. (Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse); Obert, J.; Putaux, J.C. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

By chemical evaporation technics, neutron deficient Hafnium nuclei have been on-line separated at the ISOCELE facility, from the isobar rare-earth elements, in the metal-fluoride HfF^{+}_{3} ion form. Half-lives of $^{162-165}Hf$ have been measured. Similarly, Tantalum has been selectively separated on the TaF^{+}_{4} form.

41296 (KFTI—81-8, pp 43-45) **Experience and development program for the I.V. Kurchatov Atomic Energy Institute electron linear accelerator.** Aref'ev, A.V.; Blokhov, M.V.; Gerasimov, V.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. (In Russian). NTIS (US Sales Only), PC A04/MF A01.

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1981).

A program of physical investigations and the corresponding requirements to accelerated beam parameters are discussed in brief. The state and working capacity of separate units and the accelerator as a whole for the 8-year operating period are analyzed. The aim and principal program points of linear electron accelerator modernization are defined. The program of accelerator modernization assumes: electron beam energy increase up to 100-120 MeV; mounting of three additional accelerating sections; klystron efficiency increase; development of a highly reliable modulator; stabilized power supply sources; a system of synchronous start-up; a focusing system; a beam separation system and etc.

41297 (KFTI—81-8, pp 46-49) **Results of modernization and use of the 2 GeV linear accelerator during 10th Five-Years.** Antipov, K.I.; Artemov, V.I.; Dem'yanenko, G.K. 1981. (In Russian). NTIS (US Sales Only), PC A04/MF A01.

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1981).

Modernization of systems of the LU-2 electron linac and improvement of beam parameters are described, the information about operating modes and time usage is given. The data on reliability of separate linac systems are presented. The accelerator operating efficiency improvement achieved for the last 5 years is due to the beam intensity growth, conducting of new experiments, development of multibeam regimes.

41298 (KFTI—81-8, pp 50-54) **Development of heavy ion linear accelerators.** Bomko, V.A.; Khizhnyak, N.A. 1981. (In Russian). NTIS (US Sales Only), PC A04/MF A01.

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1981).

A review of the known heavy ion accelerators is given. It is stated that cyclic and linear accelerators are the most perspective ones in the energy range up to 10 MeV/nucleon according to universality in respect with the possibility of ion acceleration of the wide mass range. However, according to the accelerated beam intensity of the heavier ions the linear accelerators have considerable advantages over any other types of accelerators. The review of the known heavy ion linac structures permits to make the conclusion that a new modification of an accelerating structure of opposite pins excited on a H-wave is the best one.

41299 (KFTI—81-8, pp 54-55) **Startup of induction linear accelerator-injector of installation for study of collective acceleration methods.** Bogdanov, O.S.; Vakhrushin, Yu.P.; Volzhek, A.A. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1981. (In Russian). NTIS (US Sales Only), PC A04/MF A01.

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1981).

The LIU-5/5000 induction linear electron accelerator was started in at ITEP in December, 1978, and the basic rated parameters were attained in 1979. The electron beam parameters are the following: energy is 5 MeV, current in the pulse is 2kA, duration of the plane, part of the pulse is up to $50x10^{-9}$s, pulse-repetition frequency is $0.25\text{-}1s^{-1}$. The accelerator was under operation during 1500 h without any serious breakdowns. The systems of the accelerator and problems appeared during their adjustment are described. The present works at the accelerator are directed towards improvement of electron beam quality and its stability.

41300 **(PB—82-100165) Resonance neutron radiography using an electron linac. Final report.** Schrack, R.A.; Behrens, J.W.; Johnson, R.; Bowman, C.D. (National Bureau of Standards, Washington, DC (USA)). Apr 1981. 4p. Proceedings of Conference on Application of Accelerators in Research and Industry (1980), North Texas State Univ., Denton, TX., November 3-5, 1980. IEEE Transactions in Nuclear Science NS-28, n2 p1640-1643 Apr 81.

The NBS electron LINAC is being used to implement a resonance neutron radiography system. Position-sensitive proportional counters indicate location and time of arrival of neutrons transmitted through the material being radiographed, this information is stored in an on-line computer system in a million word storage array for later analysis. Neutron transmission data is collected for a region from about 3 to 12 eV neutron energy. Measurements have been made using silver, tungsten, gold, and the uranium isotopes.

41301 **(PB—82-100173) Efficient neutron production using 12 MeV electrons. Final report.** Bowman, C.D. (National Bureau of Standards, Washington, DC (USA)). Apr 1981. 3p. Proceedings of Conference on Application of Accelerators in Research and Industry (1980), North Texas State Univ., Denton, TX., November 3-5, 1980, IEEE Transactions in Nuclear Science NS-28, n2 p1485-1487 Apr 81.

A comparison of (gamma,n) and atomic cross sections shows that neutron production with an electron beam can be as energy efficient with 12-MeV electrons as with the conventionally used 30- to 100-MeV electrons. Neutron production from tungsten using 100-MeV electrons is compared with a thin tungsten converter followed by a deuterium-containing target using electrons near 12 MeV. For a BeD2 target, a yield of 2 x 10 to the 12th power neutrons per kilojoule of beam power is predicted.

41302 **IPCR cyclotron progress report.** Ambe, F.; Hashizume, A.; Kamitsubo, H.; Odera, M.; Wada, T.; Gono, Y.; Hattori, Y.; Nomura, T.; Uda, M. (eds.). *IPCR Cyclotron Progress Report;* No. 14, 1-231(Dec 1980).

Research programs during 1980 at IPCR are summarized. The report is divided into the following major areas: machine development and accelerator physics; nuclear physics, scattering and reactions; nuclear physics, nuclear spectroscopy and instrumentation; atomic and solid-state physics; radiochemistry and nuclear chemistry; radiation chemistry and radiation biology; radiation monitoring; heavy ion linear accelerator project; and separated-sector cyclotron project. (GHT)

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 40313, 40335, 41183, 41185, 41422, 41451, 41882, 41886

41303 **Anode mounting for window type Geiger--Mueller tube.** Levy, S. US Patent Application 221,953. [nd]. Filed date 31 Dec 1980. 7p.

To prevent the anode wire which runs along the axis of the tube from vibrating at the end adjacent the window, a ceramic cup has a flat surface sealed to the inside of the window, and the end of the anode wire is captured within an opening of the cup.

41304 **Optical dosimeter.** Drukaroff, I.; Fishman, R. US Patent Application 217,361. [nd]. Filed date 17 Dec 1980. 9p.

An object of the invention is to obtain the advantage of a long light path for more optical materials than is feasible with optical fibers to provide an optical dosimeter. According to the invention, a reflecting optical dosimeter is a thin block of optical material having an input light pipe at one corner and an output light pipe at another corner, arranged so that the light path includes several reflections off the edges of the block to thereby greatly extend its length. In a preferred embodiment, one corner of the block is formed at an angle so that after the light is reflected several times between two opposite edges, it is then reflected several more times between the other two edges.

41305 **(AD-A—097992/2) Calibration of radiac calibrator type AN/UDM-1A. Technical note.** Jones, E.W.; Benyon, D.E. (Defence Research Establishment, Ottawa, Ontario (Canada)). Oct 1980. 26p. (DREO-TN—80-14). NTIS PC A03/MF A01.

The Radiac Calibrator type AN/UDM-1A has recently been acquired and installed at 9 Canadian Forces Bases across Canada and in Europe. The AN/UDM-1A Calibrator is 120 Ci of 137Cs and provides the required gamma radiation fields for the calibration of CF radiac equipment. This report provides a detailed description of the calibrator and method of the measurement of the gamma fields.

41306 **(AD-A—098040/9) Rapid response density probe fabrication and testing. Final report.** Golobic, R.A. (Research Analysis and Development, Inc., Colorado Springs, CO (USA)). Feb 1981. 88p. NTIS PC A05/MF A01.

A new air density-measuring probe has been manufactured and tested. The measurement technique is based upon measurement of the energy decay of radioactive alpha particles as they traverse through the air. The probe consists of an alpha particle source, a detector, and signal-processing electronics. The system is designed to measure high-frequency (up to 20 kHz) density fluctuations as well as mean density. Testing was performed using a low-speed heated jet. Accurate mean density measurements were demonstrated. However, noise in the processing electronics prevented accurate unsteady readings.

41307 **(GSF-B—1131) Dosimetry of 3 MeV and 14 MeV neutrons with the ferrous sulphate solution.** Pejuan, A. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Frankfurt am Main (Germany, F.R.). Abt. fuer Biophysikalische Strahlenforschung). Mar 1980. 128p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE82780376.

The aim of the present work is to determine the G value of a standard ferrous sulphate solution for neutrons with mean energies of 3 MeV and 14 MeV. The number of the transformed Fe ions is evaluated by means of a spectrophotometrical procedure and the absorbed energy is determined by applying the ionometrical method. Special attention is paid to the calculation of the mean total dose in the irradiated sample taking radiation attenuation into account. For this purpose the spatial distribution of absorbed energy within the probe is determined. Further, it is investigated how the fraction of the γ component in the total absorbed dose varies in the sample, in order to evaluate its mean value, which is needed for the final determination of the G value for the neutron component.

41308 (LMF—91, pp 15-17) **Mobile field sampling system for determining submicron aerosol size distributions.** Evans, J.M.; Cheng, Y.S.; Newton, G.J. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The need to accurately measure size distributions of submicron aerosols in field situations was recognized. A mobile system was assembled consisting of three size distribution measuring instruments, a 1.1 μm aerodynamic diameter cyclone precutter and a simple dilution method. The new system reduced data collection time, required only one operator (previous systems required two) and was successfully used in several field and laboratory applications.

41309 (LMF—91, pp 211-214) **High volume aerosol particle sampling system.** Wolf, I.; Lopez, J.A.; Mokler, B.V. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

A high volume sampling system was designed and fabricated for collecting large quantities of airborne particulate material on a single filter. The principal feature of the system is a simple control loop that monitors the pressure drop across an orifice and automatically adjusts a relief valve on the inlet of an exhaust blower. The control loop maintained nearly constant flow through the filter. The unit was used to sample diluted exhaust from a 5.7 liter displacement diesel engine operating on a simulated variable load driving cycle. Flow rates through the sampling system were maintained between 123 and 130 cfm despite a fluctuating pressure drop of as much as 1.2 psi during a 23-minute duty cycle/sampling period.

41310 **(PB—81-206401) Directory of commercial calibration services for ionizing radiation survey instruments.** (Conference of Radiation Control Program Directors, Inc. (USA)). Apr 1981. 77p. NTIS, PC A05/MF A01.

This directory lists information provided by commercial services that calibrate survey instruments used to measure ionizing radiation, and information on the availability of calibrated radioactive sources. Companies included in this directory are cross-referenced. The first listing is by state, subdivided into the instrument calibration and source manufacturer categories. This listing includes the types of radiation services offered, calibration method(s) used, estimated calibration accuracies, radiation energy and intensity ranges, and types of instruments and radioactive sources manufactured or calibrated. The second list summarizes the services offered by radiation type. In the final list, each company is shown with its address, telephone number, and a contact person. Included in the appendices is information on possible sources of inaccuracy in calibrating survey instruments and on the properties of common calibration sources.

41311 **Evaluation of a time-of-event method for measurement of very low levels of radioactivity.** Kaye, J.H.; Kinnison, R.R.; Merrill, J.A.; Brauer, F.P. (Battelle Pacific Northwest Labs., Richland, WA (USA)). *Nuclear Instruments and Methods in Physics Research;* **193**: No. 1/2, 169-175(15 Feb 1982).

From 5. symposium on x- and gamma-ray sources and applications; Ann Arbor, MI, USA (10 - 12 Jun 1981).

A time-of-event counting system is described and its application to counting low levels of radionuclides is discussed. If it is assumed as a first approximation that the detector efficiency is a constant, then the time-of-event methods do not result in improved detection limits relative to the grouped data methods. It is concluded that at very low counting rates the counter efficiency effect must be described by a function obeying the laws of geometric statistics. In addition, it was shown that the time-of-event method provides a useful diagnostic tool for monitoring the performance of a counting system during the course of a counting measurement.

41312 **CAMAC gamma-ray scanning system.** Moss, C.E.; Pratt, J.C.; Shunk, E.R. (Los Alamos National Lab., NM (USA)). *Nuclear Instruments and Methods in Physics Research;* **193**: No. 1/2, 229-233(15 Feb 1982).

From 5. symposium on x- and gamma-ray sources and applications; Ann Arbor, MI, USA (10 - 12 Jun 1981).

A flexible gamma-ray scanning system, based on a LeCroy 3500 multichannel analyzer and CAMAC modules, is described. The system is designed for making simultaneous passive and active scans of objects of interest to nuclear safeguards. The scanner is a stepping-motor-driven carriage; the detectors, a bismuth-germanate scintillator and a high-purity germanium detector. A total of sixteen peaks in the two detector-produced spectra can be integrated simultaneously, and any scan can be viewed during data acquisition. For active scanning, the 2615 keV gamma-ray line from a ^{232}U source and the 4439 keV gamma-ray line from $^{9}Be(\alpha,n)^{13}C$ were selected. The system can be esaily reconfigured to accommodate up to seven detectors because it is based on CAMAC modules and FORTRAN. The system is designed for field use and is easily transported. We present and discuss examples of passive and active scans.

41313 **Multi-energy gamma-ray automated scanning system.** Hsu, H.H.; Pratt, J.C.; Shunk, E.R. (Los Alamos National Lab., NM (USA)). *Nuclear Instruments and Methods in Physics Research;* **193**: No. 1/2, 235-238(15 Feb 1982).

From 5. symposium on x- and gamma-ray sources and applications; Ann Arbor, MI, USA (10 - 12 Jun 1981).

A CAMAC-based gamma-ray scanning system was used to measure the transmission through stacked attenuators for up to 16 different gamma rays. For each measurement, we obtained the transmission for gamma rays ranging in energy from 77 to 2614 keV. These transmission measurements were used to produce a set of linear equations that may be solved for either thickness or density of the discrete attenuators comprizing a given stacked assembly.

41314 **The BRH test pattern for gamma camera performance (an evaluator).** Paras, P. US Patent Application 254,097. 2 Mar 1981. 15p.

The present invention relates to evaluation of the performance of nuclear medicine imaging systems and, more particularly, to a transmission test pattern which can be utilized to determine the performance parameters of gamma cameras. The test pattern or phantom of the present invention provides information on gamma camera performance parameters which cannot be measured with imaging procedures employed in the prior art for gamma camera performance evaluation.

41315 **Pulsed radiation dosimetry apparatus.** Cappelli, J.R. US Patent Application 6,227,558. 22 Jan 1981. 20p.

A pulsed radiation dosimetry apparatus utilizes a pin diode to detect pulsed radiation that may be produced by either a particle accelerator or a flash x-ray device. The detected radiation signal is integrated and then directly displayed on a digital meter. The present apparatus provides a direct readout of radiation dose in rads.

41316 **Improving the performance of personnel portals for safeguards.** Krusel, L.W. (Sandia, Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **38**: 179-181(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41317 **Gamma ray coincidence analysis system.** Friauf, W.S. US Patent Application 228,681. 1981. Filed date 26 Jan 1981. 16p.

This invention relates to positron emission tomographs, and more particularly to a gamma ray coincidence analysis system for a multichannel nuclear emission tomograph of the type employing rings of scintillation detectors arranged in quadrants, with respective detectors defining scintillation detection channels.

41318 **Improved bismuth germanate detector for ionizing radiation.** Piltingsrud, H.V. US Patent Application 200,513. 24 Oct 1980. 14p.

Disclosed is a modification of conventional scintillation cameras wherein the conventional scintillation crystal composed of NaI(Tl) is replaced with a crystal of Bi4Ge3O12(BGO). The BGO crystal is cooled below room temperature in order to improve the light emission characteristics of the crystal. In a preferred embodiment, both the BGO crystal or crystals and the associated photomultiplier tubes are surrounded with a refrigeration device in order to cool the entire assembly to less than room temperature, in a preferred embodiment minus 78.6C.

41319 **Multistage time averaging filters for timing measurements with large counters.** Theodosiou, G.E.; Dawson, J.W. (Argonne National Lab., IL (USA). High Energy Physics Div.). *Nuclear Instruments and Methods;* **172**: No. 3, 491-499(1 Jun 1980).

A method is described which uses multistage logic circuitry to accurately determine the 'true time' that a particle traverses as long counter essentially independent of the 'hit' position. The accuracy increases rapidly with the number of stages used in the circuit. Several channels of the simplest type with about +-70 ps resolution over a total range of 4.2 ns have been built, tested and used successfully in experiment E450 at the ZGS.

41320 **Nuclear pulse discriminator.** Friauf, W.S.; Brooks, R.A. US Patent Application 209,305. 1980. Filed date 21 Nov 1980. 17p.

This invention relates to apparatus for measuring nuclear radiation, and more particularly to a discriminator intended to be used in conjunction with a scintillation detector to detect gamma rays, or with other types of particle detectors. The discriminator is intended to be used in conjunction with a bismuth germanate scintillation detector to detect gamma rays, but may also be used with other types of particle detectors.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

REFER ALSO TO CITATION(S) 41183

41321 **(AD—320936/8) The relative effect of blast and radiation of a low-altitude nuclear detonation on ordnance electronic materiel.** SEIJO, E. (Diamond Ordnance Fuze Labs., Washington, DC (USA)). Nov 1960. 20p. NTIS PC A02/MF A01.

No abstract available.

41322 **(AD-A—103897/5) Cosmic ray effects on microelectronics. part i. the near-earth particle environment. Memorandum report.** Adams, J.H. Jr; Silberberg, R.; Tsao, C.H. (Naval Research Lab., Washington, DC (USA)). 25 Aug 1981. 95p. NTIS, PC A05/MF A01.

It has recently been recognized that a single intensely ionizing particle can alter the information stored in a modern semiconductor memory and possibly do permanent damage to the microelectronic circuit involved. Such particles are common in nature and abundant in space. This report describes the natural particle environment in which modern space-borne electronics must operate, and provides a simple but accurate empirical model of that environment.

41323 **(NASA-CR—166628) TIROS-N cosmic ray study.** Blandford, J.T. Jr.; Pickel, J.C. (Rockwell International Corp., Anaheim, CA (USA)). Sep 1980. 92p. NTIS, PC A05/MF A01.

An experimental and analytical study was performed on the impact of galactic cosmic rays on the TIROS-N satellite memory in orbit. Comparisons were made of systems equipped with the Harris HMI-6508 1 x 1024 CMOS/bulk RAM and the RCA CDP-1821 1 x 1024 bit CMOS/SOS RAM. Based upon the experimental results, estimated bit error rates were determined. These were at least 8.0 bit errors/day for a 300 kilobit memory with the HMI-6508 and .014 bit errors/day with the CDF-1821. It was also estimated that the HMI-6508 latchup rate in orbit is at least two orders of magnitude less than the bit error rates the CDP-1821 will not latchup.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 40737, 41195, 41281, 41359, 41360, 41361, 41362, 41363, 41365, 41366, 41445

41324 **(BDX—613-2770) Resolution of contamination problems affecting Laser-Surface-Certification inspection.** Jackson, L.C. (Bendix Corp., Kansas City, MO (USA)). Mar 1982. Contract AC04-76DP00613. 21p. NTIS, PC A02/MF A01. Order Number DE82008775.

Contamination from particulate and organic residues has interfered with the Laser Surface Certification (LSC) inspection of some parts, subsequently preventing their certification to the Ernest Orlando Lawrence Livermore National Laboratory (LLNL) product specification. Contamination was found to come from three sources: particulate and organic residues from polishing compounds; organic films from cleaning solvents; and particles and organic residues transferred from plastic fixtures used to process these parts. The manufacturing cleaning process was not effective in removing all polishing compound residues, and an extensive cleaning procedure was developed using two solvents in a multicycle ultrasonic/vapor degreasing procedure. Parts were then subjected to gas plasma cleaning which removed the organic films left by the solvent cleaning. Plastic and rubber materials were evaluated for their contamination transfer characteristics; a fluorocarbon elastomer was the least contaminating. Inspection data established the efficacy of the cleaning procedure. After design relaxation, Bendix Kansas City was able to rely on a single-stage ultrasonic vapor degreasing process to achieve product acceptance.

41325 **(BPO-RDR—831) Demountable-lens couplings for optical-fibre communications systems. Research Department report No. 831.** Stewart, J.H.; North, J.C. (Post Office Research Centre, Ipswich (UK)). 22 Jan 1980. 13p. Post Office Research Centre, Martlesham Heath-IPSWICH IP5 7RE, England.

Described are the design and evaluation of the connectors used on the optical fibre systems currently operating between Martlesham and Ipswich.

41326 (LMF—91, pp 280-283) **System for exposing animals to radiolabeled diesel exhaust.** Lopez, J.A.; Wolf, I.; Wolff, R.K.; Sun, J.D.; Mokler, B.V. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

One approach to determining the deposition and fate of inhaled diesel particles is the conduct of inhalation exposure studies with radiolabeled diesel fuel. A system was designed, constructed and tested for the simultaneous exposure of animals to radiolabeled diesel exhaust and collection of large quantities of radiolabeled diesel exhaust particles from a single cylinder diesel engine. The system performance was characterized and evaluated over a range of operating conditions: 0 to 1800 watts of engine load, 1000 to 2500 rpm and dilution air rates of 1:2 and 1:10. The exposure system met required design and operating criteria for safety, portability, space and flexibility.

41327 (LMF—91, pp 342-346) **Collection and characterization of stack emissions from fluid bed combustor.** Cheng, Y.S.; Carpenter, R.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

This report describes preliminary field sampling results on the fluidized bed combustor at Morgantown Energy Technology Center (METC) during a 30-hour test of an electrostatic granular bed filter test. Emphasis was placed on collecting large quantities of stack particulate samples for physicochemical and biological characterization. The sampling system consisted of a Massive Volume Air Sampler (MVAS), a high volume filter sampler and auxiliary samplers. Size-classified samples were obtained by the MVAS. Comparison of mass concentration and size distribution measured by MVAS and other samplers indicated that if it was operated at optimal conditions, tens of grams of size-classified particulate samples can be obtained in a few hours.

41328 **(NUREG/CR—1903) Advanced two-phase flow instrumentation program quarterly progress report for July-September 1980.** Turnage, K.G.; Davis, C.E.; McCulloch, R.W.; Anderson, R.L.; Miller, G.N. (Oak Ridge National Lab., TN (USA)). 30 Jan 1981. 25p. (ORNL/NUREG/TM—430). NTIS PC A02/MF A01.

Work performed to develop and evaluate liquid level sensors for in-vessel use in pressurized-water reactors is described. Techniques used to fabricate heated thermocouple (HTC) probes are presented. Experiments were performed with five thermal-type liquid level sensors in natural convection to saturated water and steam. Pressures in those tests ranged from 0.1 to 8.6 MPa (15 to 1250 psia). Test goals were to study sensor repeatability and optimize splash shield designs. An HTC was installed in the upper plenum of the Thermal Hydraulic Test Facility and tested during steady-state film boiling tests. The HTC performed well except at high test section outlet velocities. Tests intended to prove the principle of the temperature-compensated ultrasonic liquid level instrument were performed in high-temperature saturated liquid water and steam. The mean densities obtained using the ultrasonic device agreed with those from pressure difference measurements, within experimental error.

41329 **Helium-jet coupled mass separator - advances and directions.** Moltz, D.M. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods in Physics Research;* **186**: No. 1/2, 135-139(1 Jul 1981).

From 10. international conference on electromagnetic isotope separates and techniques related to their applications; Zinal, Switzerland (1 - 6 Sep 1980).

Results from the RAMA-88 system at the Lawrence Berkeley Laboratory are being used to design a new helium-jet and ion source system for the UNISOR project. This system should complement the existing integrated target-ion source to extend UNISOR's capabilities to include a majority of the chemical elements. This fast transport helium-jet system should permit studies of nuclides with half-lives down to 50 ms.

41330 **Advances in the helium-jet coupled on-line mass seperator RAMA.** Moltz, D.M.; Aeystoe, J.; Cable, M.D.; Parry, R.F.; Haustein, P.E.; Wouters, J.M.; Cerny, J. (California Univ., Berkeley (USA). Dept. of Chemistry; California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Instruments and Methods in Physics Research;* **186**: No. 1/2, 141-147(1 Jul 1981).

From 10. international conference on electromagnetic isotope separates and techniques related to their applications; Zinal, Switzerland (1 - 6 Sep 1980).

General improvements to the on-line mass separator RAMA have yielded a greater reliability and efficiency for some elements. A new utilitarian helium-jet chamber has been installed to facilitate quick target and degrader foil changes in addition to a new ion source holder. A higher efficiency hollow-cathode, cathode-extraction ion source for lower melting point elements ($< 1200^{0}$C) has also been designed. Tests with the beta-delayed proton emitter ^{37}Ca showed a factor of five increase in yield over the old hollow-cathode, anode-extraction source. A differentially-pumped tape drive system compatible with both γ-γ and β-γ experiments has been incorporated into the general detection system. All major operating parameters will soon be monitored by a complete stand-alone microprocessor system which will eventually be upgraded to a closed-loop control system.

41331 **Basic studies of a gas-jet-coupled ion source for on-line isotope separation.** Anderl, R.A.; Novick, V.J.; Greenwood, R.C. (Idaho National Engineering Lab., Idaho Falls (USA)). *Nuclear Instruments and Methods in Physics Research;* **186**: No. 1/2, 153-163(1 Jul 1981).

From 10. international conference on electromagnetic isotope separates and techniques related to their applications; Zinal, Switzerland (1 - 6 Sep 1980).

A hollow-cathode ion source was used in a gas-jet-coupled configuration to produce ion beams of fission products transported to it from a ^{252}Cf fission source. Solid aerosols of NaCl and Ag were used effectively as activity carriers in the gas-jet system. Flat-plate skimmers provided an effective coupling of the ion source to

the gas jet. Ge (Li) spectrometric measurements of the activity deposited on an ion-beam collector relative to that deposited on a pre-skimmer collector were used to obtain separation effeciencies ranging from 0.1% to > 1% for Sr, Y, Tc, Te, Cs, Ba, Ce, Pr, Nd and Sm. The use of CCl_4 as a support gas resulted in a significant enhancement of the alkaline-earth and rare-earth separation efficiencies.

41332 **Isotopic ratio measurement at abundance sensitivities greater than 1:10^{15}. A comparison between mass spectrometry at keV amd MeV energies.** Purser, K.H. (General Ionex Corp., Newburyport, MA (USA)); Williams, P. (Illinois Univ., Urbana (USA)); Litherland, A.E. (Toronto Univ., Ontario (Canada)); Stein, J.D.; Storms, H.A. (General Electric Co., Pleasanton, CA (USA)); Gove, H.E. (Rochester Univ., NY (USA)); Stevens, C.M. (Argonne National Lab., IL (USA). Chemistry Div.). *Nuclear Instruments and Methods in Physics Research;* **186**: No. 1/2, 487-498(1 Jul 1981).

From 10. international conference on electromagnetic isotope separates and techniques related to their applications; Zinal, Switzerland (1 - 6 Sep 1980).

The mass abundance sensitivities of the best conventional mass spectrometers are about 10^{-10} in the uranium region and 10^{-11} for low masses. This is about five orders of magnitude below several measurements that have been made using the new accelerator-centered mass spectrometry technique. The reasons for this dramatic increase in sensitivity are discussed. This improvement is not the result of any single effect but rather the compounding of several, each contributing several orders of magnitude. As an example, a tandem accelerator-centered double mass spectrometer is analyzed. For this geometry, significant background elimination is accomplished by: (1) The removal of all molecular interferences by fragmentation; (2) reduction in scattering cross sections; (3) simultaneous measurements of E, dE/dx and range for each event; (4) the use of negative ions. It is pointed out that with suitable ion sources the accelerator-centered technique has the potential of unambiguously detecting a single atom of specific mass and atomic number for many elements.

41333 **Instrument for measurement of exposure from laser radiation.** Silberberg, J.L. US Patent Application 202,727. 31 Oct 1980. 66p.

The instrument of the present invention is adapted for use by official inspection personnel, such as by Food and Drug Administration (FDA) personnel in determining the duration of safe viewing of a source of visible laser radiation. A laser whose output can enter the naked human eye indefinitely and cause no discernible damage is classified as a Class I laser. The laser meter of the present invention measures the optical energy as a function of time and compares the measured value with the accessible emission limit for Class I lasers (promulgated under 21 CFR, Subchapter J, Part 1040) at various critical points in time. A 3-digit engineering-notation display format is used to output the computed time at which the laser energy exceeds the Class I limit as well as the total energy measured in 10 seconds.

45 EXPLOSIONS AND EXPLOSIVES

4502 Nuclear

REFER ALSO TO CITATION(S) 41321, 41561

41334 **(AD-A—097708/2) Suitability of ARES for simulating tactical burst EMP environments. Topical report, 15 January-1 April 1980.** Holst, D.W. (Mission Research Corp., Santa Barbara, CA (USA)). 1 Apr 1980. 73p. (MRC-R—565). NTIS PC A04/MF A01.

The possibility of using the ARES to evaluate source region coupling in tactical systems is discussed. A 'tactical' source region is defined and the environment at the inner edge of this source region is determined for a 50 kt burst at a range of 1.2 km. The time and amplitude characteristics of the ARES pulse are compared with those from the selected environment. Coupling of the ARES and the source region fields into a short monopole antenna and small loop are compared. These objects are representative of those found in tactical systems. Based upon these results suggestions are made for augmenting and supplementing testing in the ARES to obtain responses representative of the source region.

41335 **(AD-A—097817/1) Experimental spectral analysis of SALMON/STERLING decoupling. Technical report.** Blandford, R.R.; Woolson, J.R. (Teledyne Geotech, Alexandria, VA (USA). Seismic Data Lab.). 30 Nov 1979. 64p. (SDAC-TR—79-3). NTIS PC A04/MF A01.

Re-analysis of SALMON and STERLING initial short-period compressional and surface waves at station PLMS (Poplarville, Mississippi) at a distance of 27 km shows a SALMON/STERLING compressional phase spectral ratio tending to a ratio of only 17 at 25 Hz in agreement with the theoretical caculations of Patterson (1966) and of Healy, King, and O'Neill (1971). The spectral ratio for the surface waves tends to a ratio of approximately 100 at 25 Hz, in agreement with spectral ratios previously reported by Springer, Denny, Healy, and Mickey (1968), whose data window at PLMS was large enough to consist predominantly of surface waves. The fact that the ratio varies as a function of phase suggests that decoupling varies as a function of takeoff angle, with the least decoupling occurring at high frequencies for the most steeply departing rays. Another topic discussed is the apparent variation in decoupling as defined by the ratio of STERLING/STERLING HE. The variation in this ratio is determined to be explainable by the variation in short point between these two explosions, and not necessarily by a variation in decoupling as a function of azimuth.

41336 **(AD-A—098292/6) Carbon rod radiant source for blast/fire interaction experiments: proof of concept and design. Interim report, 28 March 1979-30 August 1980.** Cockayne, J.E.; Malinowski, R.L.; Meisner, J.L. (Science Applications, Inc., McLean, VA (USA)). 30 Aug 1980. 93p. (SAI—81-245-WA). NTIS PC A05/MF A01.

The investigation of the blast interaction with fires ignited by the nuclear flash requires controlled experiments. A simulator for the pulse of thermal energy is needed in order to properly initiate the fire. This report addresses the development of carbon rod radiant source (CARRS) that is compatible with the FEMA long-duration shock/blast tube at Camp Parks, California. The effort commenced with an understanding of the specific requirements and pertinent research, both past and present. Evaluation of the alternate candidates provided direction for a proof of concept experiment. Subsequent steps produced a laboratory scale (constant 25 kw) model for investigating the electrical, mechanical and optical issues of a 1.8 Mw peak power CARRS. A conservative design was done, which may soon be 'overcome by events' in pulsed power technology.

41337 **(AD-A—103024/6) Camelot-a novel concept for a multiterawatt pulse power generator for single pulse, burst, or repetetion rate operation. Special report.** Stewart, A.G. (Harry Diamond Labs., Adelphi, MD (USA)). Apr 1981. 19p. NTIS, PC A02/MF A01.

Superpower pulse generators are fast establishing themselves internationally as candidates for employment in a wide variety of military applications including electronic warfare and jamming, high energy beam weapons, and nuclear weapons effects simulation. Unfortunately, existing multimegajoule pulse power generators such as AURORA do not satisfy many Department of Defense goals for field-adaptable weapon systems-for example, repetition (rep) rate operation, high reliabilty, long life, ease of operation, and low maintenance. The Camelot concept is a multiterawatt rep ratable pulse power source, adaptable to a wide range of output parameters-both charged particles and photons. An analytical computer model has been developed to predict the power flowing through the device. A 5-year development program, culminating in a source region electromagnetic pulse simulator, is presented.

41338 **(AD-A—103828/0) Shot Smoky, a test of the Plumbbob series, 31 August 1957. Technical report.** Harris, P.S.; Lowery, C.; Nelson, A.G.; Obermiller, s.; Ozeroff, W.J. (JAYCOR, Alexandria, VA (USA)). 31 May 1981. Contract DNA001-78-C-0311. 155p. NTIS, PC A08/MF A01.

This report describes the activities of DOD participants in the atmospheric nuclear test, SMOKY, conducted on 31 August 1957 as part of the PLUMBBOB series. The various levels at which DOD personnel participated within the Nevada Test Organization and Desert Rock projects are described. Those projects related to DOD mission activities are described as to purpose, agency, results, operation, and radiological safety aspects.

41339 **(AD-A—103829/8) Shot GALILEO, a test of the Plumbbob series, 2 september 1957. Technical report.** Ponton, J.; Wilkinson, M.; Striegel, J.; Collins, B. (JRB Associates, Inc., McLean, VA (USA)). 27 Feb 1981. Contract DNA001-79-C-0473. 85p. NTIS, PC A05/MF A01.

This report describes the activities of DOD personnel, both military and civilian, in Shot GALILEO, the 16th nuclear test in the PLUMBBOB atmospheric weapons testing series. The test was conducted on 2 September 1957 and involved participants from Exercise Desert Rock VIII, AFSWP, AFSWC, and AEC test groups. This volume also describes the radiological safety criteria and procedures in effect at Shot GALILEO.

41340 **(AD-A—103834/8) NUDACC(Nuclear Damage Assessment Computer Code) programmer's guide: version ii. Special report.** Geipe, T.M. (Harry Diamond Labs., Washington, DC (USA)). Jun 1981. 25p. NTIS, PC A02/MF A01.

This report serves as a second version to the Nuclear Damage Assessment Computer Code (NUDACC) Programmer's Guide (HDL-SR-80-1). The initial report served as a user's manual for the analyst or the programmer interested in installing and using NUDACC. As such, the initial report contained a description of NUDACC methodology as well as detailed descriptions of file structure, mass storage requirements, and logic flow. Recent major improvements in the computer code have involved the handling of the input vulnerability data. These improvements significantly affect the logic of the computer code described in the initial report, thus creating the need for the up-to-date user's manual represented by this report.

41341 **(AD-A—104189/6) Regional ground motions from a one megaton surface burst. Final report 15 Nov 78-31 May 80.** Barker, T.G. (Systems, Science and Software, La Jolla, CA (USA)). Sep 1980. Contract F19628-79-C-0003. 78p. NTIS, PC A05/MF A01.

Ground motions from a numerical simulation of a one megaton nuclear surface burst are propagated to regional distances (3.5 to 350 miles) through earth models appropriate to three sites at Minuteman Wings IV, V and VI. Synthetic ground motions and response spectra are examined and compared as functions of range and earth structure. In addition, the ground motions due to the airblast alone were compared with those due to the full surface burst simulation and were found to provide a good approximation to the full solution.

4503 Explosion Detection

41342 **(FOA-C—20382-T1) International Seismological Data Center. Output of an experimental data base.** Barkeby, G. (Research Inst. of National Defence, Stockholm (Sweden)). Nov 1980. 158p. NTIS PC A08/MF A01.

Temporary international seismological data center facilities were set up at the Hagfors Observatory. The facilities are for the compilation of an experimental data base and computer programs for automatic and interactive analysis of seismic data. The analysis includes three parts: (1) defining and associating short period observations (2) associating long period observations and (3) calculation of short period identification parameters for seismic events. The output of the automatic analysis is listed for a one week demonstration period. Results are considered adequate for verifying compliance with a comprehensive test ban on underground nuclear explosions.

41343 **(FOA-C—20384-T1) International Seismological Data Center: compilation of identification data.** Israelson, H. (Research Inst. of National Defence, Stockholm (Sweden)). Nov 1980. 33p. NTIS PC A03/MF A01.

The problem of compiling data for identifying seismic events is adressed. Such data compilation would be conducted by special international data centers as part of a system to monitor compliance with a comprehensive test ban on underground nuclear explosions. Temporary international seismological data center facilities were set up at the Hagfors Observatory. Identification parameters were limited to short period P waves. Results illustrate the necessity of introducing station corrections before compiling multistation data for a seismic event.

41344 **(UCRL—53247) Source effects on surface waves from Nevada Test Site explosions.** Patton, H.J.; Vergino, E.S. (Lawrence Livermore National Lab., CA (USA)). Nov 1981. Contract W-7405-ENG-48. 69p. NTIS, PC A04/MF A01. Order Number DE82009357.

Surface waves recorded on the Lawrence Livermore National Laboratory (LLNL) digital network have been used to study five underground nuclear explosions detonated in Yucca Valley at the Nevada Test Site. The purpose of this study is to characterize the reduced displacement potential (RDP) at low frequencies and to test secondary source models of underground explosions. The observations consist of Rayleigh- and Love-wave amplitude and phase spectra in the frequency range 0.03 to 0.16 Hz. We have found that Rayleigh-wave spectral amplitudes are modeled well by a RDP with little or no overshoot for explosions detonated in alluvium and tuff. On the basis of comparisons between observed and predicted source phase, the spall closure source proposed by Viecelli does not appear to be a significant source of Rayleigh waves that reach the far field. We tested two other secondary source models, the strike-slip, tectonic strain release model proposed by Toksoez and Kehrer and the dip-slip thrust model of Masse. The surface-wave observations do not provide sufficient information to discriminate between these models at the low F-values (0.2 to 0.8) obtained for these explosions. In the case of the strike-slip model, the principal stress axes inferred from the fault slip angle and strike angle are in good agreement with the regional tectonic stress field for all but one explosion, Nessel. The results of the Nessel explosion suggest a mechanism other than tectonic strain release.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 41308, 41636

41345 (LMF—91, pp 10-14) **Aerosols from oxy-acetylene gas cutting operations on metal plates: a laboratory study.** Wong, B.A.; Newton, G.J.; Obarski, G.E.; Hoover, M.D. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The decommissioning of radioactively contaminated sites has the potential for creating radioactive and other potentially toxic aerosols. Laboratory studies characterized aerosols from oxy-acetylene cutting of carbon steel and stainless steel, and steel coated with stable Cs, Cd and Sr to simulate fission product contamination. Aerosol characteristics were studied with an electrical aerosol analyzer, a scanning electron microscope, filters, cascade impactors and an HCl impinger trap. Quantification of aerosolized products was by atomic absorption spectroscopy. In general, gas cutting operations produced a multicomponent, multimodal, respirable-sized aerosol.

41346 **(NASA-TM—82123) Infrared radiative transfer through a regular array of cuboidal clouds.** Harshvardhan; Weinman, J.A. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). May 1981. 31p. NTIS PC A03/MF A01.

Infrared radiative transfer through a regular array of cuboidal clouds is studied and the interaction of the sides of the clouds with each other and the ground is considered. The theory is developed for black clouds and is extended to scattering clouds using a variable azimuth two-stream approximation. It is shown that geometrical considerations often dominate over the microphysical aspects of radiative transfer through the clouds. For example, the difference in simulated 10 micron brightness temperature between black isothermal cubic clouds and cubic clouds of optical depth 10, is less than 2 deg for zenith angles less than 50 deg for all cloud fractions when viewed parallel to the array. The results show that serious errors are made in flux and cooling rate computations if broken clouds are modeled as planiform. Radiances computed by the usual practice of area-weighting cloudy and clear sky radiances are in error by 2 to 8 K in brightness temperature for cubic clouds over a wide range of cloud fractions and zenith angles. It is also shown that the lapse rate does not markedly affect the exiting radiances for cuboidal clouds of unit aspect ratio and optical depth 10.

41347 **(PB—81-132839) Chalk Point Cooling Tower Project: Chalk Point Meteorological Station report. Volume I. Interim report, 1 July-30 November 1978.** (Environmental Systems Corp., Knoxville, TN (USA)). Jan 1979. 23p. NTIS, PC A02/MF A01.

This report documents the operation, maintenance, calibration, data acquisition, and data reduction at the Chalk Point Meteorological Station for the period July 1, 1978 to November 30, 1978. The meteorological tower system was checked and calibrated on a regular basis during the period and monthly progress reports generated. Climatological data summaries for each month and calibration data are included together with the meteorological systems data recovery for the period.

41348 **(PB—81-132847) Chalk Point Cooling Tower Project: Point Meteorological Station report. Volume II. Interim report, 15 November 1978-15 November 1979.** (Environmental Systems Corp., Knoxville, TN (USA)). Dec 1979. 58p. NTIS, PC A04/MF A01.

This report documents the operation, maintenance, calibration, data acquisition and data reduction at the Chalk Point Meteorological Station for the period November 15, 1978 through November 15, 1979. Climatological data summaries for each month and calibration data are included together with the meteorological systems data recovery for the period.

41349 **(PB—81-141301) Scientific and technical publications of the Environmental Research Laboratories. Fiscal year 1978, October 1, 1977-September 30, 1978.** (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Environmental Research Labs.). Jun 1980. 48p. NTIS, PC A03/MF A01.

The Environmental Research Laboratories' work is aimed at supporting the present assignments and developing the future services of NOAA. Programs include investigation of ocean processes and their interactions with the atmosphere; studies of the ocean environment as it is affected by waste disposal and development of energy resources; fundamental studies of the upper atmosphere and space environments; lower atmosphere research on the weather and climates; research on tsunamis, severe local storms, and hurricanes; studies of weather modification, and the environmental effects of global pollution or similar influences on ecology; and development of equipment, instruments, systems, and facilities for these programs. The listing presented is an index of ERL output for the period October 1, 1977 through September 20, 1978. The list includes all known articles published in journals for this period, as well as those reports published within the official series of the laboratories. Publications resulting from research contracts or grants, and work done by cooperating institutes or on international aid programs are included.

41350 **(PB—81-860470) Carbon dioxide and climate. January, 1970-May, 1981 (Citations from Pollution Abstracts). Report for January 1970-May 1981.** (National Technical Information Service, Springfield, VA (USA)). May 1981. 45p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning studies, research, observations, and analyses of the effects or impacts of natural and anthropogenic perturbations or changes in the global carbon dioxide system. A wide variety of carbon dioxide sources and impact mechanisms are considered. Much of the research involves mathematical modeling aimed at forecasting weather modification, climatic change, and biological impacts. (Contains 48 citations fully indexed and including a title list.)

41351 **Trend in surface and upper air temperatures.** Angell, J.K. (Air Resources Labs., NOAA, Silver Spring, MD). pp 241-245 of Interpretation of climate and photochemical models, ozone and temperature measurements (La Jolla Institute, 1981). Reck, R.A.; Hummel, J.R. (eds.). New York, NY; American Institute of Physics (1982).

From Workshop on responsible interpretation of atmospheric models and related data; La Jolla, CA, USA (9 Mar 1981).

Based on radiosonde-derived temperature records from 1958 through 1980, the global surface temperature, and mean 0 to 16 km temperature, were warmer in 1980 than in any previous year. This was due primarily to a continuing warming trend in the tropics, with recent warming also indicated for north and south temperate latitudes and south polar latitudes. There has been no evidence of warming in north polar latitudes. In the 16 to 24 km layer there has been a tendency for cooling since the eruption of Mt. Agung in 1963, most obviously in the Southern Hemisphere. Northern Hemisphere rocketsonde data suggest a considerable cooling in middle and high stratosphere between 1970 and 1977, with little temperature change thereafter. Thus, the evidence is rather impressive for surface and tropospheric warming, and stratospheric cooling, during the past decade.

41352 **Modeling the lowest 1 km of the atmosphere.** Lewellen, W.S. Neuilly-sur-Seine, France; Advisory Group for Aerospace Research and Development (1981). 88p. (AGARD-AG—267). National Technical Information Service (NTIS), 5285 Port Royal Rd., Springfield, VA 22161.

Portions of document are illegible.

The interdependence between the turbulent transport of mass, momentum, and energy through the lower levels of the atmosphere, and the distribution of wind, temperature, and species within this layer are reviewed. Particular emphasis is placed on models, either analytical or numerical, which have a basic theoretical foundation in turbulent transport modeling. The results of example model solutions are used to discuss such micrometeorological problems as: wind shear and turbulence around airports; the prediction of low-level clouds and fog; the dispersion of industrial pollutants; the interaction of electromagnetic radiation with turbulent fluctuations in humidity and temperature; and the evolution of organized features within the boundary layer.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 40136, 40147, 40148, 40154, 40157, 40195, 40715, 40716, 41068, 41070, 41071, 41181, 41182, 41309, 41326, 41327, 41352, 41424, 41633, 41638, 41639, 41640, 41641, 41653, 41679

41353 **(AD-A—103118/6) Reevaluation of nitric oxide concentration in exhaust of jet engines and combustors. Final report 1 October 1979-30 September 1980.** Few, J.D.; Lowry, H.S. III. (Arnold Engineering Development Center, Arnold Air Force Station, TN (USA)). Aug 1981. 27p. (AEDC-TR—80-65). NTIS, PC A03/MF A01.

Several measurements of nitric oxide (NO) concentrations in the exhaust of jet engines and combustors by probe sampling and ultraviolet (UV) resonance absorption have been reported. Generally, the optically determined concentrations have exceeded the probe determined values appreciably. The theoretical basis for the determination of the NO concentration from absorption measurements has recently been reexamined, and the values previously

reported were redetermined. Upon reexamination, the parameter a (the ratio of collisional plus natural half-width to the Doppler half-width) was found to obey the relationship a = C P/T sub 0 to the 1.5 power where P is the pressure in atmospheres, T is the temperature in K, and C is a constant. The value of C was found to be 3.81 (+ or - .40) x 10,000 k to the 1.5 power/atm. The major conclusion of previous studies remains unchanged, namely, that optically determined NO concentrations may be a factor of 5 larger than probe determined values or may be the same, depending on the combustion gas flow conditions and/or probe design. However, certain optically determined NO concentrations varied by as much as 46 percent from previously reported values because of alterations made to the theory and parameters.

41354 **(DOE/EV/10725—2) Potential significance of tropical organic soils for the carbon balance of the terrestrial biosphere.** Armentano T.V. (Institute of Ecology, Indianapolis, IN (USA)). 1981. Contract AC02-81EV10725. 22p. (CONF-8110167—1). NTIS, PC A02/MF A01. Order Number DE82011827.

From International Society for Tropical Ecology jubilee symposium; Bhopal, India (1 Oct 1981).

A major question concerned with the terrestrial component of the world carbon cycle is the extent to which different carbon pools act as sources or sinks for atmospheric carbon dioxide. Emphasis has been placed on tropical and temperate forests which contain over 75% of the carbon stored in the terrestrial biosphere (Ajtay et al. 1979). Although there is considerable uncertainty about rates, increased clearing of tropical forests is probably reducing the total quantity of stored carbon, creating a net carbon source. Other ecosystems such as grasslands, savannahs and wetlands also are contributing to biospheric carbon exchange. Pressures for development of tropical wetlands are mounting as food requirements rise (Thompson 1979, Howard-Williams 1976). In some areas, particularly in Africa and southeast Asia, nearly all well-drained, arable lands are already fully utilized. Thus whether tropical wetlands are operating as net carbon sinks or net carbon sources depends on the extent to which they are being altered. This paper reviews available data on tropical wetlands in relation to the carbon cycle and identifies organic soil deposits for which additional data are needed for a complete analysis of the present and future carbon balance.

41355 **(EPRI-EA—2217) Nitrogen oxide transformations in power plant plumes.** Sverdrup, G.M.; Spicer, C.W.; Kuhlman, M.R. (Battelle Columbus Labs., OH (USA)). Jan 1982. 158p. NTIS, PC A08/MF A01. Order Number DE82901847.

This Interim Report describes laboratory research on the chemical transformations nitrogen oxides might undergo after emission from fossil-fueled power plants. Kinetic data are being obtained in the laboratory on the conversion of NO to NO_2 and further oxidation of NO_2 to form gaseous and particulate nitrates. These data will be used to develop a chemical component for inclusion in reactive plume models. These models may be used to assess the impact of emitted NO/sub x/ on downwind air quality with resulting impacts on health and visibility, as well as acid precipitation. The objectives of the research program are to: (1) identify those reactions involving NO/sub x/ which are potentially important in power plant plumes, (2) acquire chemical kinetic data on those reactions where uncertainty exists, and (3) provide improved chemical kinetic models for estimation of the fate of NO/sub x/ in power plant plumes. The experimental design involves experiments on near- and far-field homogeneous chemistry and heterogeneous chemistry. Liquid phase droplet chemistry is not being studied.

41356 **(EUR—7034-EN) Critical apraisal of mathematical models of explosive gas cloud dispersion. Final report.** Fischer, K.; Geiger, W.; Heudorfer, W.; Schnatz, G. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). 1981. 67p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Portions of document are illegible.

One of the factors to be taken into accont in designing nuclear power plants to resist external events is the conceivable pressure loading by gas cloud explosion. This external pressure loading substantially depends on the maximum possible size, shape and drift width of the explosive part of the gas cloud and their variation in time. The aim of this study is to compare the existing mathematical models for the formation and dispersion of explosive gas clouds and to assess them in terms of accuracy of results, field of application and physical effects allowed for.

41357 **(GKSS—81/E/34) Determining the absorption cross sections of atmospheric pollutants in the IR range.** Pokrowsky, P. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1981. 79p. (In German). GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.).

Thesis.

The absorption cross sections of the most important pollutants SO_2, N_2O, NO, NO_2, NH_3, H_2S and HCl were determined at wavelength between 3.5 and 4.0 μm in support of systems for the detection of air pollution by infrared absorption measurements. With a DF-laser lidar system SO_2, N_2O, and HCl can be detected in the atmosphere at low concentrations. A system for the local detection of air pollutants was built. Sensitive detection was achieved by using a frequency modulated diode laser spectrometer. This spectrometer was used in a field experiment for the measurement of HCl in the plume of incineration ships.

41358 (LMF—91, pp 215-219) **Surface area and adsorption studies on diesel exhaust particles.** Rothenberg, S.J. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Specific surface area, desorption half-times and weight loss curves were determined for three samples of diesel exhaust particles. Data were obtained over the temperature range 25°C to 600°C. Over 25 percent of the sample was material volatile at 250°C and 10^{-6} torr. Apparent specific surface areas were strongly dependent on the outgassing temperature. Desorption half-times exceeded a minute for all samples over the entire temperature range studied. Adsorption of xylene by heat-treated samples was studied over the relative pressure (P/P^0) range 0.05 to 0.9. Xylene adsorption isotherms demonstrated sharp kneepoints at $P/P^0 < 0.05$, corresponding to heats of adsorption of xylene of $\approx$ 13 kcal.

41359 (LMF—91, pp 353-356) **Evaluation of a Massive Volume Air Sampler.** Cheng, Y.S.; Carpenter, R.L.; Evans, J.M. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The evaluation of a Massive Volume Air Sampler (MVAS) for collecting gram quantities of particulate matter in a relatively short period of time is reported. The MVAS had a flow rate about 17 m^3/minute and consisted of 2 impactor stages followed by an electrostatic precipitator section, resulting in 3 size classified fractions. Flow rate was measured by a pitot tube and compared with calculated values. Size distribution of a uranine-tagged CsCl aerosol as measured by MVAS was in agreement with a Lovelace multijet impactor. Electron micrographs of aerosols collected on different collection stages showed 3 distinguishable but overlapping size fractions.

41360 (LMF—91, pp 357-360) **Non-ideal collection characteristics of a cascade impactor with various collection substrates.** Barr, E.B.; Newton, G.J.; Yeh, H.C. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

A series of collection substrates was used to evaluate the dependence of collection efficiency on substrate type in one stage of a seven-stage cascade impactor. Data obtained were used to determine which substrates yielded the best collection characteristics for cascade impactors. Stainless steel, silver membrane filters, and cellulose acetate membrane filters as cascade impactor collection substrates showed stage collection characteristics that closely fit theoretical predictions. Fiber type substrates showed the most deviation from the theoretical efficiency curve.

41361 (LMF—91, pp 361-364) **Optimizing resolution and sampling rate in spinning duct aerosol centrifuges.** Hoover, M.D.; Morawietz, G.; Stoeber, W. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Resolution of particle size groups in spinning duct aerosol centrifuges can be optimized for a given particle size range by proper selection of total flow rate and rotational speed. Lower total flow rates and higher rotational speeds favor resolution of particles less than 1 μm aerodynamic diameter. Higher total flow rates and lower rotational speeds favor resolution for larger particles. Under any conditions, resolution is inversely proportional to relative aerosol sampling rate.

41362 (LMF—91, pp 365-367) **Evaluation of an in-line aerosol dilutor.** Yeh, H.C.; Cheng, Y.S.; Carpenter, R.L.; Evans, J.M. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The performance of a in-line, in situ aerosol diluter, consisting of a stainless steel capillary tube within a standard 47 mm Gelman filter assembly, was evaluated. The dilution ratio was found to be weakly dependent on particle size and flow rate. A theory was developed, based on the pressure drop, to predict the dilution ratio. The agreement between the theory and the data was good and within +- 10%.

41363 (LMF—91, pp 368-370) **Electrical Aerosol Analyzer: an alternate method for use at high altitude or reduced pressure.** Yeh, H.C.; Cheng, Y.S.; Kanapilly, G.M. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

To use the Electrical Aerosol Analyzer (EAA) for determining submicron aerosol size distributions at reduced pressure, a method was developed involving modifying the standard data reduction table. Based on the same principles, an alternative method was developed. A test indicated that the results from these two methods are comparable and the agreement between the two is good. The advantage of the present method is that all existing EAA data analysis packages or computer programs can be directly applied without any modification.

41364 (LMF—91, pp 371-374) **Equilibrium bipolar charge distribution of aerosols consisting of chains of uniform spheres.** Cheng, Y.S.; Yeh, H.C. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

A theory describing the equilibrium bipolar charge distribution of chain aggregates is developed based on the assumption that the individual constituents of an aggregate acquire a charge state according to Boltzmann's law, and that the charge of the aggregate is the sum of the individual charges within the aggregate. Theoretical charge distributions for doublets and triplets of 0.5 μm primary particles were in agreement with published experimental data. The charge distribution of chain aggregates can be represented by the Boltzmann charge distribution of an equivalent length diameter sphere with a diameter equal to the product of the primary particle number and the diameter of the primary particle.

41365 (LMF—91, pp 375-378) **Generation of ammonium sulfite aerosol for inhalation exposure of guinea pigs.** Rothenberg, S.J.; Harkema, J.R.; Barr, E.B.; Silbaugh, S.A.; Dahl, A.R. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

An ammonium sulfite generator, adjustable to give exposure levels between 5 and 500 mg/m^3 at a chamber flow of 90 liters per minute was built. The generator used the gas phase reaction of ammonia, sulfur dioxide and excess water vapor and a nitrogen carrier gas. Provided the reaction vessel was cooled below 10°C, a respirable aerosol with a mass median aerodynamic diameter ~ 2 μm and a standard deviation ~ 1.8 was obtained in the animal exposure chamber. Air oxidation of the moist aerosol in the exposure chamber was rapid.

41366 (LMF—91, pp 520-524) **Toxicity of small glass fibers. I. Generation and characterization of aerosols.** Carpenter, R.L.; Pickrell, J.A.; Mokler, B.V. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Methods were developed to generate and characterize aerosols of glass insulation fibers for chronic exposures. Fischer-344 rats were then exposed to the fibers in a 19-day period. The aerosol contained 42,000-61,000 fibers/ml. Fiber lengths and diameters were used to classify fibers in a length/diameter matrix to allow estimation of fiber volume distribution. Average fiber length was 11.4 μm and average fiber diameter was 0.16 μm and 6 to 8% of the fibers were longer than 20 μm.

41367 (PB—81-141574) **Atmospheric chemistry of selected sulfur-containing compounds. Outdoor smog chamber study, Phase 2. Final report, July 1978-March 1980.** Sickles, J.E. II; Wright, R.S. (Research Triangle Inst., Research Triangle Park, NC (USA)). Jan 1981. 224p. NTIS, PC A10/MF A01.

The photochemical behavior of mixtures of selected sulfur containing species, hydrocarbons, and nitrogen oxides was examined in outdoor smog chambers. Sulfur dioxide, H_2S, CH_3SH, COS, and thiophene are the sulfur species tested. A surrogate ambient hydrocarbon mixture comprised of 25% propene and 75% butane known as the EKMA mix was selected. An experimental matrix was designed where initial EKMA mix concentrations ranged from 0.0 to 2.0 ppMC, initial NO/sub x/ concentrations ranged from 0.0 to 0.4 ppM, resulting in initial HC/NO/sub x/ ratios of 0. to 40. The impact of the sulfur species on the behavior of the EKMA Mix-NO/sub x/ system was examined by conducting experiments at various points on the matrix with and without 1 ppm of each sulfur species. A total of 172 single-chamber experiments was conducted over 43 test days. The experimental results were analyzed to determine the impact of each test sulfur species on the production of ozone, SO_3 (where appropriate), and particulate sulfur. In selected cases, the influence of each test species on the average hydroxyl radical concentration was examined.

41368 (PB—81-145187) **Emissions assessment of conventional stationary combustion systems. Volume IV. Commercial/institutional combustion sources. Final report, September 1976-December 1980.** Surprenant, N.F.; Hung, P.; Li, R.; McGregor, K.T.; Piispanen, W. (TRW, Inc., Redondo Beach, CA (USA)). Jan 1981. 207p. NTIS, PC A10/MF A01.

The report characterizes air emissions from commercial/institutional external combustion sources and reciprocating engines and is the fourth of a series of five project reports characterizing emissions from conventional combustion sources. This characterization was based on a critical examination of existing data, followed by a modified Level 1 sampling and analysis approach to resolve data gaps. The major deviation from Level 1 procedures was the additional of GC/MS analysis for polycyclic organic matter (POM). Tests were conducted at 22 external and six internal combustion sites. Results of the environmental assessment indicate that air emissions from these sources represent a potential environmental hazard. Emissions of criteria pollutants, except for CO, from most of the source categories tested are environmentally significant. Particulate, SO4, and SO3 emissions from the coal- and wood-fired sources are also significant. In addition, emissions of several trace elements are of concern: Al, Ba, Be, Ca, Cl, Co, Cr, Cu, F, Fe, K, Li, Na, Ni, P, Pb, Si, and V from coal-fired external combustion sources; Ni from distillate oil sources; and Ni, Cl, Cr, and V from residual oil sources. Several potentially hazardous POM compounds were tentatively identified in the emissions from solid-fuel-fired sources, particularly from one wood-fired stoker tested.

41369 (PB—81-179772) **Technique for measuring reduced forms of sulfur in ambient air. Report for August 1979-October 1981.** Braman, R.S.; Ammons, J.M. (University of South Florida, Tampa (USA)). Apr 1981. 58p. NTIS PC A04/MF A01.

A new technique for measuring low concentrations of volatile sulfur compounds in ambient air is discussed. The technique consists of preconcentration of sulfur compounds by chemisorption on gold metal coated sand or gold foil surface followed by thermal desorption, separation, and detection by flame photometry. Breakthrough capacities are on the order of 1 microgram total sulfur compounds. The unique aspect of this research is the derivation of thiol type compounds, principally H2S and CH3SH, by ethyl iodide for partial separation of H2S, DMS, SO2, COS, and CH3SH. Best suited for the 0.01-5 ppb range, the technique has been used to detect trace sulfur compound concentrations as low as 0.001 ppb by volume with 100L and larger sample volumes. Sample size detection limits depend upon the type of flame photometric detector used but are generally in the 0.1 ng range. Repeatability of measurements is + or - 5-8% relative standard deviation. Accuracy depends upon the compound. DMS and SO2 are detected as individual compounds. H2S, CS2 and COS are detected as a single compound on gold foil. Methylmercaptan and dimethyldisulfide appear as a single compound. Field studies at two sites, Cedar Island NC and Prairie View, Texas, have demonstrated that the technique is practical for field use and for determining vertical profiles up to 10 meters above ground level. Hydrogen sulfide, dimethylsulfide, sulfur dioxide and carbonylsulfide were the principal reduced forms of sulfur detected at these sites.

41370 **(PB—81-183535) Statistical investigations on the atmospheric transfer of sulfur dioxide over medium distances.** Dietzer, B. (Technische Hochschule Darmstadt (Germany, F.R.)). 1980. 142p. NTIS PC A07/MF A01.

Thesis.

After an introduction, data material, SO2 measurements, meteorological measurements, a testing of the SO2 measured values and the test method are presented, followed by emission statistics, including hourly average line values, an episode statistic, a definition of the transport episodes, frequency of the appearance of transport episodes, their duration and relationship to large-scale weather conditions, monthly and yearly mean values, SO2 wind direction distributions. This is followed by studies of individual cases in episodes in January, June and December of 1976 and a description of the SO2 ground concentrations with a statistic model, including the mathematical bases, the statistical model for the entire period of time, the proper vector, regression equations for the proper coefficients, a comparison with measured values, an inclusion of the thermal layering and concluding comments on the statistical model, followed by a list of parameters and the bibliography.

41371 **(PB—81-185118) Use and limitations of in-stack impactors. Final report.** Lundgren, D.A.; Balfour, W.D. (Florida Univ., Gainesville (USA). Dept. of Environmental Engineering Sciences). Feb 1980. 126p. NTIS PC A07/MF A01.

A systematic evaluation of the operating parameters for four commercially available in-stack cascade impactors was carried out with polydisperse test aerosols. Test aerosols used were polystyrene latex spheres, uranine, sodium chloride, dioctyl-phthalate, or dinonyl phthalate. The effect upon the apparent measured size distribution of each polydisperse test aerosol was noted for various gas sampling rates (flow rates), types of impactor collection surfaces (glass fiber, uncoated aluminum, and aluminum coated with silicone), stage loadings and interstage losses. Collection surfaces were further characterized as to their weight loss during exposure to elevated temperatures and their tendency to be blown off by an impinging jet of air. Measurements revealed that interstage losses may amount to 30% of the total collected mass; however, there is little effect upon the apparent measured size distribution when these losses are ignored. The useful range of flow rates available for the impactors was defined at the lower end by a loss of useful sizing data and at the upper end by the presence of particle bounce off the latter stages. In general, the impactors were found to give similar apparent measured size distributions when operated at various flow rates within this useful range. Recommendations were made for: (1) optimum operation of the impactor when sampling various types of aerosols, and (2) accounting for observed or known errors in the data.

41372 **(PB—81-185670) Fabric filter system study: annual report (2nd). Report for October 1978-October 1979.** Ladd, K.L.; Chambers, R.L.; Plunk, O.C.; Kunka, S.L. (Southwestern Public Service Co., Amarillo, TX (USA)). Mar 1981. 203p. NTIS PC A10/MF A01.

The report describes the second year's activities of a comprehensive EPA-funded study of a commercial fabric filter on a 350-MW low sulfur coal-fired unit at Southwestern Public Service Company's Harrington Station, near Amarillo, Texas. Special tests were performed to characterize gaseous and particulate emissions, to evaluate fabric performance, and to optimize the fabric filter system's performance. Tests will continue. Test results confirmed that the unit can operate in compliance with the existing New Source Performance Standard (NSPS) of 0.1 lb/million Btu. Because NOx concentrations were consistent at all five sampling locations, NOx will be excluded from future testing. Test results from the stack indicated that the unit can meet existing NSPS for SO2; results correlated well with stoichiometric calculations. During other tests: mass emissions of particulate measured at the stack ranged from 0.007 to 0.034 lb/million Btu; average particulate collection efficiency was about 99.3%; the mean particle diameter was 5.4 micrometers at the stack exit; SO2 emissions were within NSPS of 1.2 lb/million Btu; NOx emissions were consistent across the entire baghouse; and SO3 emissions ranged from 0.3 to 3 ppm.

41373 **(PB—81-186728) Atmospheric turbulence and pollutant dispersion near roadways.** Rao, S.T.; Keenan, M.T.; Sistla, G.; Wilson, J.S. (New York State Dept. of Environmental Conservation, Albany (USA)). Dec 1980. 142p. NTIS PC A07/MF A01.

The major objectives of this investigation are: (1) to determine the time and space scales of the eddies generated by the traffic, (2) to study the effects of traffic-induced turbulence on the near-field dispersion of pollutants, (3) to evaluate several commonly used highway air pollution dispersion models, and (4) to improve methods of modeling pollutant dispersion near roadways. To this end, meteorological and tracer concentration data from two field experiments, namely, General Motors and New York State, are used.

41374 **(PB—81-188542) Effect of parameters of filtration on dust cleaning fabrics. Final report 1976-79.** Koscianowski, J.R.; Koscianowska, L.; Szczepankiewicz, E.; Werynski, B.; Bethke, S. (Institute of Industry of Cement Building Materials (Poland)). Mar 1981. 466p. NTIS PC A20/MF A01.

The report summarizes 4 years of laboratory and large-scale tests on the dust filtration process and the basic filtration parameters that determine performance. Physical parameters describing fabric and dust cake structure were defined and three basic dust filtration mechanisms were considered: selective precipitation, inertial sedimentation, and diffusion. From test results of two Polish polyester fabrics filtering separated fly ash, three-dimensional probabilistic models of dust collection efficiency and filtration resistance were introduced. Also developed was a general filtration model, based on random field theory, that included full mathematical augmentation. The effect of electrostatic phenomena on dust filtration was examined in an attempt to define its influence. Study conclusions included: (1) air flow through a clean fabric and the dust filtration process are normal stochastic processes; (2) dust filtration is a specific dry filtration process, differing from the air filtration process or the high-efficiency air filtration process; (3) dust collection efficiency during the dust filtration process depends on three basic filtration mechanisms related to the aerosol particle size distribution; and (4) woven filtration materials are heterogenous and anistropic media characterized by periodic structure that, at high face velocity values exhibit transition region flow of Kl.

41375 **(PB—81-198673) The measurement and identification of ultrafine aerosols in polluted air. Final report Jun 78-Jun 79.** Podzimek, J.; Carsten, J.C.; Yue, P.C. (Missouri Univ., Rolla (USA). Graduate Center for Cloud Physics Research). Mar 1981. 169p. NTIS, PC A08/MF A01.

The UMR-Absolute Aitken Nuclei counter (UMR-AAN) was compared with the following relative counters: the N-P counter, the General Electric (GE) automatic counter, and the

Gardner counter (GA). The UMR-AAN counter exhibited consistently higher counts than the others. The mean deviations (calculated for AN concentration ranges from 300 to 20,000/CC) varied between 20 and 50% depending on the type of counter and the nature and concentration of the test aerosol (NaCl, (NH4)2SO4, Ni-Cr wire, carbon and room air). Several observations are made concerning the generation and storage of the test aerosol, as well as on ultrafine particle counting. As a guide to the description of droplet formation and growth in an Aitken nuclei (AN) counter, the basic thermophysical processess in the central region of the N-P counter are analyzed in some detail. Final radii and characteristic growth times are calculated and tabulated.

41376 **(PB—81-200529) Guideline for applying the airshed model to urban areas.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Oct 1980. 174p. NTIS, PC A08/MF A01.

Guidance is provided to potential model users on the capabilities of the Airshed Model, its data requirements, and its application to control strategy analyses. The Airshed Model is an urban-scale, grid-based, photochemical dispersion model. Its greatest utility lies in studying the relationship of emissions of volatile organic compounds and nitrogen oxides to ambient ozone levels observed in major metropolitan areas. However, the model may be used to estimate ambient short-term concentrations of nitrogen dioxide and carbon monoxide as well. The guideline should enable air pollution control agencies and others to carry out the planning activities and to evaluate the level of resources needed to apply the model.

41377 **(PB—81-200636) Aeros manual series. Volume 5. Aeros manual of codes. Update Number 3.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Mar 1981. 50p. NTIS, PC A03/MF A01.

Contents include: General geographical codes; NEDS specific codes; SAROAD specific codes; SOTDAT specific codes; HATREMS specific codes.

41378 **(PB—81-201188) Directory of volatile organic compound sources covered by Reasonably Available Control Technology (REACT) requirements. Volume I: Group I RACT categories.** Mehta, D.H.; Spessard, J.E. (PEDCo-Environmental, Inc., Arlington, TX (USA)). Feb 1981. 273p. NTIS, PC A12/MF A01.

The U.S. Environmental Protection Agency is demonstrating and evaluating the use of photochemical models. These models require accurate and complete inventory data bases. To insure that all major volatile organic compound (VOC) sources are included in emission inventory data bases, and to insure that VOC emission inventories for photochemical oxidant nonattainment areas include all sources that are subject to Reasonably Available Control Technology (RACT), this directory of VOC sources covered by RACT requirements has been derived independently of EPA inventory data. This report is Volume 1 of a 3-volume series.

41379 **(PB—81-201196) Directory of volatile organic compound sources covered by Reasonably Available Control Technology (RACT) requirements. Volume II: Group II RACT categories.** Mehta, D.H.; Spessard, J.E. (PEDCo-Environmental, Inc., Arlington, TX (USA)). Feb 1981. 289p. NTIS, PC A13/MF A01.

The U.S. Environmental Protection Agency is demonstrating and evaluating the use of photochemical models. These models require accurate and complete inventory data bases. To insure that all major volatile organic compound (VOC) sources are included in emission inventory data bases, and to insure that VOC emission inventories for photochemical oxidant nonattainment areas include all sources that are subject to Reasonably Available Control Technology (RACT), this directory of VOC sources covered by RACT requirements has been derived independently of EPA inventory data. This report is Volume 2 of a 3-volume series.

41380 **(PB—81-201204) Directory of volatile organic compound sources covered by Reasonably Available Control Technology (RACT) requirements. Volume III: Group III RACT categories.** Mehta, D.H.; Spessard, J.E. (PEDCo-Environmental, Inc., Arlington, TX (USA)). Feb 1981. 460p. NTIS, PC A20/MF A01.

The U.S. Environmental Protection Agency is demonstrating and evaluating the use of photochemical models. These models require accurate and complete inventory data bases. To insure that all major volatile organic compound (VOC) sources are included in emission inventory data bases, and to insure that VOC emission inventories for photochemical oxidant nonattainment areas include all sources that are subject to Reasonably Available Control Technology (RACT), this directory of VOC sources covered by RACT requirements has been derived independently of EPA inventory data. This report is Volume 3 of a 3-volume series.

41381 **(PB—81-202715) Evaluation of applicability of the Incoll procedure as an I/M strategy. Technical report.** Smuda, B. (Environmental Protection Agency, Ann Arbor, MI (USA). Inspection and Maintenance Staff). Nov 1980. 53p. NTIS, PC A04/MF A01.

This report presents testing results which were gathered to investigate the suitability of using the INCOLL procedure as an emissions inspection and maintenance (I/M) testing procedure compared to existing I/M testing procedures. The INCOLL procedure utilizes engine and transmission inertial forces to produce pressures and temperatures in the engine that will generate significant quantities of exhaust emissions. The existing I/M test procedures utilize steady state engine operating modes to produce significant quantities of exhaust emissions. The test sequency consisted of FTP, INCOLL, LA-4 and I/M cycles. The test sequence was applied to six vehicles in various states of tune.

41382 **(PB—81-234817) Response factors of VOC analyzers at a meter reading of 10,000 ppmv for selected organic compounds. Final report December 1980-February 1981.** DuBose, D.A.; Harris, G.E. (Radian Corp., Austin, TX (USA)). Mar 1981. 30p. NTIS, PC A03/MF A01.

The report summarizes results of a reinterpretation of data generated in a laboratory study of the sensitivity of two types of portable hydrocarbon detectors to a variety of organic chemicals. (A previous report, PB81-136194, describes and gives original results of the laboratory study.) Detector sensitivity is quantified by a response factor for each chemical where the response factor equals the actual concentration of the chemical divided by the observed concentration from the detector. The previous report estimated response factors at 10,000 ppmv actual concentration of the chemical. This report presents response factors estimated for a 10,000 ppmv detector reading. The instruments were calibrated to 7993 ppmv methane gas.

41383 **(PB—81-234965) Effectiveness of the regulatory process and source performance: San Diego, California, case study. Final task III report.** Cunningham, R.; Baker, J.; Bryan, B.; Freeman, G. (Pacific Environmental Services, Inc., Santa Monica, CA (USA)). Jul 1979. 117p. NTIS, PC A06/MF A01.

This report evaluates the relationship between source performance and the regulatory process, including effectiveness in promoting compliance with the standards, source performance and response factors, suggestions for incremental modification to the existing regulations, and suggestions for further analysis involving other legal and administrative modifications.

41384 **(PB—81-235301) Acoustical concept for measuring particle size distributions.** Mahler, D.S.; Kaufman, M. (KLD Associates, Inc., Huntington, NY (USA)). Feb 1981. 74p. NTIS, PC A04/MF A01.

A new concept is investigated for measuring particle size and distribution for air pollution control applications. This study illustrates that the proposed device--the Acoustic Particulate Monitor (APM)--can measure total mass loading, mean particle diameter, and width of particle size distributions on an in-situ basis. The concept for such an instrument is based upon experimental and theo-

retical observations that the presence of dust in air causes a reduction in the speed of sound as a function of the transmitted frequency. These percentage reductions in the speed of sound are small and the research results illustrate how the accompanying shift in the acoustical phase is a highly sensitive method for detecting such effects. The magnitudes of the phase shift are related to mass loading. The frequency associated with the maximum phase shift is defined as the acoustic frequency, fA. Experimentally determining fA provides a measure of the mean particle size of the distribution. The detailed shape of the phase shift as a function of frequency is a measure of the spread in the size distribution of the entrained particulate. Experiments were performed using several configurations. Results were verified using direct mass measurements and microphotographs.

41385 **(PB—81-238305) Compilation of air pollutant emission factors: highway mobile sources. Final report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Mar 1981. 408p. (EPA—460/3-81-005). NTIS, PC A18/MF A01.

This is the Compilation of Air Pollutant Emission Factors: Highway Mobile Sources, March 1981 (EPA 460/3-81-005) document. It summarizes the emission factors and calculation methodologies used in the MOBILE2 computer program. The emission factors are presented for eight individual vehicle types in three regions of the country. This document describes the basic test procedures used to collect the hydrocarbon (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) emissions and the generalized emission factors calculation equations. The emissions presented in this document are the basic exhaust emissions, the crankcase and evaporative HC emissions, January 1 basic exhaust emission levels, and idle exhaust emissions. Further, non-methane HC fractions and particulates are presented. In addition to the standard test procedure emissions, emission correction factors are presented to adjust the emissions for various ambient and vehicle usage conditions such as speed, temperature, and humidity for NOx.

41386 **(PB—81-242232) Air pollution emissions inventory systems. Appendix C. Emissions inventory in the Federal Republic of Germany.** (North Atlantic Treaty Organization, Brussels (Belgium). Committee on the Challenges of Modern Society). Aug 1980. 175p. (NATO/CCMS—104-APP-C). NTIS, PC A08/MF A01.

This document is an appendix to report Number 104; it gives a general overview of emissions inventory systems and methods used in the Federal Republic of Germany.

41387 **(PB—81-242257) Air pollution pilot study: assessment methodology and modeling, 1975-1979 (first follow-up report).** (North Atlantic Treaty Organization, Brussels (Belgium). Committee on the Challenges of Modern Society). 31 Aug 1980. 139p. (NATO/CCMS—114). NTIS, PC A07/MF A01.

Report is first follow-up report of Federal Republic of Germany about the recommendations made by the Air Pollution Pilot Study Assessment Methodology and Modeling (1975-1978). Report concentrates on recommendations of the final report which was NATO/CCMS, No. 105. There is reference to exchange of information on application of the Air Quality Management Systems (AQMS) methods and techniques as described in the technical documents of the study.

41388 **(PB—81-242323) Air pollution emissions inventory systems. Appendix F. Emissions inventory in the United States of America.** (North Atlantic Treaty Organization, Brussels (Belgium). Committee on the Challenges of Modern Society). Dec 1979. 77p. (NATO/CCMS—104-APP-F). NTIS, PC A05/MF A01.

This document is an appendix to report Number 104. It gives a general overview of emissions inventory systems and methods used in the United States of America.

41389 **(PB—81-244840) Air quality criteria for carbon monoxide.** (Informatics, Inc., Rockville, MD (USA)). Oct 1979. 324p. NTIS, PC A14/MF A01.

This document summarizes current scientific information regarding carbon monoxide (CO) as a component of the ambient atmosphere and the effects of CO upon man and the environment. The observed effects, as presented herein, constitute the basis for the criteria upon which the U.S. Environmental Protection Agency (EPA) will review the National Ambient Air Quality Standard (NAAQS) for CO. In the CO criteria document the following questions have been addressed: At what level of CO in the ambient air do detectable adverse health effects occur. What are these adverse health effects. What are the major sources of CO. Are there synergistic effects from CO exposure in humans living at high altitudes. Are present monitoring methods adequate to determine human exposure to CO. What are the global effects of increased CO emission into the atmosphere. It is in response to these and related questions that this document has been prepared.

41390 **(PB—81-245425) Photoacoustic detection of particulate carbon.** Bennett, C.A.; Patty, R.R. (North Carolina State Univ., Raleigh (USA)). Aug 1981. 52p. NTIS, PC A04/MF A01.

A photoacoustic technique for the mass monitoring of carbonaceous aerosols deposited on filter substrates has been developed. The technique involves the use of a specially designed photoacoustic cell. Photoacoustic response is calibrated as a function of elemental carbon loading using laboratory-generated elemental carbon standards. The nature of the photoacoustic response is examined at several chopping frequencies using these calibration standards, and the physical principles necessary for an adequate interpretation of the experimental results is presented in detail. Practical considerations concerning ambient carbon monitoring are outlined; in particular, the perturbation due to the presence of scattering particulates is examined and limited experimental quantification of this perturbation is reported.

41391 **(PB—81-247702) Air quality analysis for the 1984 high altitude report to Congress: summary of results. Technical report.** Wolcott, M. (Environmental Protection Agency, Ann Arbor, MI (USA)). Apr 1981. 71p. (EPA-AA-TEB—81-17). NTIS, PC A04/MF A01.

This report describes the data, assumptions, and methodology used in the air quality analysis for the 1984 High Altitude Report to Congress. Detailed descriptions of the strategies examined and the mobile source emission factors associated with each strategy are included in this report only by reference.

41392 **(PB—81-248841) Review and update of modeling analysis of carbon monoxide emissions in Mecklenburg County, North Carolina. Final report.** (Engineering-Science, Inc., McLean, VA (USA)). Jul 1981. 115p. NTIS, PC A06/MF A01.

An updated technical analysis of the carbon monoxide emissions was conducted using the state-of-the-art modeling techniques. The techniques, once calibrated with the measured concentrations, were used to forecast ambient CO concentrations at three existing monitoring sites as well as at other anticipated 'hotspots' where high concentrations might occur. The results of the analysis indicates four locations where ambient violations may occur at the end of 1987. The results of this analysis will be used to compile a control plan for the scheduled State Implementation Plan Revision in 1982 which will be able to show these hotspots in compliance with the ambient standard by the end of 1987.

41393 **(PB—81-807968) Metal processing wastes: air pollution. May 1980-July 1981 (citations from the NTIS data base). Report for May 1980-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 65p. NTIS PC N01/MF N01.

The bibliography is on air pollution from metal processing and cites control, quantity, economics, and health aspects. The citations cover broad industry studies as well as the analysis of problems of specific industrial plants and processes. The emphasis is on refining, smelting, casting, and metal working for the iron and steel, aluminum, copper, chromium, zinc, and other metal industries. (This updated bibliography contains 58 citations, all of which are new entries to the previous edition.)

41394 **(PB—81-807984) Atmospheric particle detectors. 1964-July 1981 (citations from the NTIS data base). Report for 1964-July 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 245p. NTIS PC N01/MF N01.

The cited reports cover detectors that are used primarily in air pollution and mine emission applications. Citations include monitoring site selection applicable instrumentation, and determination of particle concentration. Excluded are studies on the chemical analysis of particles. (This updated bibliography contains 247 citations, 12 of which are new entries to the previous edition.)

41395 **(PB—81-808081) Metal processing wastes: air pollution. 1976-April 1980 (citations from the NTIS data base). Report for 1976-1980.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 257p. NTIS PC N01/MF N01.

Research reports on air pollution from metal processing are cited. They include control, quantity, economics, and health aspects. The citations cover broad industry studies as well as the analysis of problems of specific industrial plants and processes. The emphasis is on refining, smelting, casting and metal working for the iron and steel aluminum, copper, chromium, zinc, and other metal industries. (This updated bibliography contains 250 citations, none of which are new entries to the previous edition.)

41396 **(PB—81-853558) Air filtration and purification. January 1970-November 1980 (citations from the NTIS Data Base). Report for January 1970-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 103p. NTIS PC N01/MF N01.

This retrospective bibliography contains information related to the removal of particulate matter and control of toxic vapors in industry as well as large urban complexes such as apartment buildings and office space. Information on safe storage of toxic solvents is also included. (Contains 76 citations, fully indexed and including a table of contents.)

41397 **(PB—81-853566) Air filtration and purification. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 88p. NTIS PC N01/MF N01.

This retrospective bibliography contains information related to the removal of particulate matter and control of toxic vapors in industry as well as large urban complexes such as apartment buildings and office space. Information on safe storage of toxic solvents is also included. (Contains 81 citations, fully indexed and including a table of contents.)

41398 **(PB—82-101114) Estimating mobile source pollutants in microscale exposure situations. Final report Jan 80-Feb 81.** Ingalls, M.N. (Southwest Research Inst., San Antonio, TX (USA)). Jul 1981. Contract EPA-68-03-2884. 162p. NTIS, PC A08/MF A01.

The goal of this study was to provide a method of estimating the concentration of any vehicle generated pollutant in areas where people are in close proximity to vehicles (microscale exposure situations). A list of common exposure situations was extracted from several hypothetical daily activity routines. These situations were: residential garages, parking garages, tunnels, street canyons and expressways. For each of the situations an appropriate dispersion model was selected from the literature for use in obtaining pollutant concentrations. To determine the exposure level for each case, the pollutant concentrations were calculated for typical and severe actual situations. The range of physical variables for each type of situation was obtained from a search of the literature, to define the typical and severe cases for each situation. Using the physical variables describing the typical and severe cases, actual locations were chosen to represent the typical and severe exposure for each situation. Pollutant concentrations were calculated for these actual locations using the chosen dispersion models. Concentrations were calculated using one gram per mile for tunnel, street canyon, and expressway situations, and one gram per minute for residential and parking garages. To use the calculated concentrations with emission factors other than one gram per mile or one gram per minute, the concentrations given in the report are multiplied by the desired emission factor in the correct units.

41399 **(PB—82-101130) Unregulated exhaust emissions from non-catalyst baseline cars under malfunction conditions. Final report Jun 80-May 81.** Urban, C. (Southwest Research Inst., San Antonio, TX (USA)). May 1981. Contract EPA-68-03-2884. 185p. NTIS, PC A09/MF A01.

This report describes the laboratory effort to characterize regulated and unregulated exhaust emissions from 1970 model non-catalyst gasoline automobiles operating under malfunction conditions. Four automobiles were evaluated over three driving schedules in the unmodified configuration and in up to three engine and/or emission control system malfunction configurations. Exhaust emission constituents measured, in addition to the currently regulated emissions, include: particulates, sulfates, aldehydes, sulfides, amines, metals and several additional elements and compounds. Additional evaluations, in each of the configurations, involved the measurement of the regulated emissions over four short-test procedures.

41400 **(PB—82-101759) Long-range transport and transformation of SO_2 and sulfate: refinement, application, and verification of models. Final report May 80-Mar 81.** Henmi, T.; Reiter, E.R. (Colorado State Univ., Fort Collins (USA)). Aug 1981. 88p. NTIS, PC A05/MF A01.

A long-range transport model of SO2 and sulfate for twenty-four-hour concentration distributions was refined and applied to calculate distribution patterns of concentration and deposition of SO2 and sulfate over the area between 35N and 45N and between 75W and 95W for January 25 and July 11, 1976. The calculated concentrations and the observed concentrations were compared. A climatological model of long-range transport of SO2 and sulfate was also refined to calculate average monthly distributions of SO2 and sulfate concentrations as well as the acidity of precipitation due to sulfate and the budget of sulfur over eastern North America. The model has been applied for the months of January 1977 and March 1979 over the area between 35N and 55N and between 62W and 95W. The results are described. Empirical studies of precipitation chemistry data were conducted and indicate that inclusion of NOx/NO3 in the long-range transport model is important to improve the predictability of precipitation acidity.

41401 **(PB—82-101932) Modeling of SO_2 oxidation in smog. Final report.** Miller, D.F. (Battelle Columbus Labs., OH (USA)). Jun 1981. 150p. NTIS, PC A07/MF A01.

Smog chamber experiments were conducted to investigate the (1) kinetics of free radical reactions of SO2 in smog and (2) SO2 transformation to sulfate for atmospheric simulations. Rate constants were derived for the following reactions: SO2+HO+M yields sulfate (60), SO2+HO2 yields sulfate (61), SO2+CH3O2 yields sulfate (64); k(60) = 1600 k(61 less than 0.2, k(64) less than 0.8 ppm min. Oxidation of SO2 by HO led exclusively to particulate sulfate. Even under favorable NOx conditions, particulate nitrate was not a product. Hydrocarbon mixtures typical of urban environments promoted SO2 oxidation faster than hydrocarbons selected to represent rural conditions. Maximum rates of SO2 oxidation occurred during periods of peak NO2 formation. SO2 oxidation rates for aged smog were 25-35% of the maximum values. Model calculations indicated that reaction 60 dominates sulfate production from SO2 in polluted air. Models that adequately estimate (HO) in smog should suffice to approximate the conversion rates. The model used in this study indicated that SO2 oxidation depends strongly on solar radiation intensity and pollutant conditions. For clear-sky and a variety of HC-NOx conditions, maximum SO2 conversion rates ranged from 3.7-7.4%/hr. Models used to simulate reactions in power plant plumes showed that SO2 oxidation is strongly dependent on plume dispersion rates coupled to the same parameters governing SO2 oxidation in ambient air. Generally the rates of SO2 oxidation in plumes are bound by the ambient rates, although exceptions will occur for certain HC-NOx conditions.

41402 **(PB—82-103326) Exhaust emissions from high-mileage catalyst-equipped passenger cars. Technical report.** Jones, G.T. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1981. 15p. NTIS, PC A02/MF A01.

This report consolidates results from a number of emission testing programs on in-use passenger cars. Vehicles from the 1975 through 1981 model years were involved. The purpose of this effort was to examine the effect of 'high mileage' on levels of exhaust emissions. The emission levels from the vehicles involved were examined from four basic views: (1) 'As received' results of the top 15% (by odometer) versus similar results from the bottom 15% and 85%; (2) 'as received' results of vehicles with over 50,000 miles versus those with under 50,000; (3) the effects of restorative maintenance on high mileage vehicles; and (4) the effects of catalyst replacement on high mileage vehicles. The results show that the high mileage vehicles exhibit higher average HC and CO emissions than the lower mileage vehicles. The higher emission levels appear to be due to an increased rate of maladjustments, disablements and defective parts. It was also found that on the average, catalytic converters remain active beyond a vehicle's statutory 'useful life' of 50,000 miles and that restorative maintenance is an effective method to reduce average emission levels. Even further reductions were possible, especially in HC, through replacement of the catalytic unit.

41403 **(PB—82-103607) Carbon monoxide commuter exposure data base: a 5-day study in Los Angeles.** Peterson, W.B.; Allen, R.H.; Ziskind, R.A.; Rogozen, M.B. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). Aug 1981. 77p. NTIS, PC A05/MF A01.

Recent concern about carbon monoxide exposure to the commuter population prompted the U.S. Environmental Protection Agency to conduct a five-day field project to assess the CO exposure to Los Angeles commuters. The purpose of this report is to document the field project and to provide the data collected during the project to the public. The data collected during this project includes measurements of interior carbon monoxide, exterior carbon monoxide and vehicle speed for three vehicles traveling typical commute routes during the morning and evening peak traffic periods. In addition, hourly average CO measurements were taken from eight South Coastal Air Quality Management District fixed-site monitoring stations and six California Transportation Agency vans in the proximity of the commuter routes.

41404 **(PB—82-105073) Emission characteristics of 1979 and 1980 California passenger cars equipped with three-way catalysts. Technical report.** Jones, G.T.; Macocha, M.M. (Environmental Protection Agency, Ann Arbor, MI (USA)). Aug 1981. 18p. NTIS, PC A02/MF A01.

This report presents exhaust emissions data gathered on in-use vehicles equipped with three-way catalyst systems. The test vehicles were 1979 and 1980 passenger cars of various makes and models. Each of the 116 vehicles tested was certified to California standards. The purpose of the program was to gather information on current systems in customer use for projections on the ability of the three-way system to meet emission standards of the future. The results indicated that vehicles equipped with these systems are capable of achieving low exhaust emission levels although high levels do occur due to defects, deterioration or tampering with the emission control equipment.

41405 **(PB—82-105230) Techniques for handling land-borne spills of volatile hazardous substances. Final report.** Brown, D.; Craig, R.; Edwards, M.; Henderson, N.; Thomas, T.J. (Battelle Columbus Labs., OH (USA)). Sep 1981. Contract EPA-68-02-1323. 101p. NTIS, PC A06/MF A01.

Response needs of teams charged with handling spills of hazardous volatile materials on land are considered by Battelle-Columbus. Items of hardware which could be adapted or developed to improve spill response capabilities are suggested. The report examines the available technology (and the lack thereof) being employed in current spill responses. An assessment of the phenomena that accompany spill volatilization is provided to determine and justify physical/chemical mechanisms that could potentially be used to control the hazards arising from volatility. As a result, approximately 60 items of hardware, which either exist or could be developed to improve hazardous volatile spill control responses, are discussed. A set of spill scenarios is developed to compare the new suggested technology items with current spill response procedures.

41406 **(PB—82-800012) Automobile air pollution: automotive fuels. 1970-August, 1981 (citations from the NTIS data base). Report for 1970-Aug 81.** (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 180p. NTIS PC N01/MF N01.

The use of fuels and fuel additives to reduce pollution from automobiles is covered in this bibliography. The use of methyl alcohol, natural gas, methane, and hydrogen is reported. Improvements to gasoline and its properties which affect air pollution are discussed, along with studies on lead additives. (This updated bibliography contains 171 citations, 24 of which are new entries to the previous edition.)

41407 **(PB—82-800020) Air pollution emission factors. 1964-August, 1981 (citations from the NTIS data base). Report for 1964-Aug 81.** (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 264p. NTIS PC N01/MF N01.

Emission factors for various industry, stationary, and mobile sources are presented in this annotated bibliography of research reports. The calculation and use of these factors are included. (This updated bibliography contains 255 citations, 29 of which are new entries to the previous edition.)

41408 **(PB—82-800293) Precipitation washout. 1964-August, 1981 (a bibliography with abstracts). Report for 1964-Aug 81.** (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 202p. NTIS PC N01/MF N01.

The reports cited in the bibliography cover the removal of pollutants, radioactive isotopes, and dust by rain and snow. The theory, modelling, sampling and effects of precipitation washout are presented. (This updated bibliography contains 194 citations, 40 of which are new entries to the previous edition.)

41409 **Atmospheric burden of CCl_3F_2.** Rowland, F.S. (Univ. of California, Irvine); Tyler, S.C.; Montague, D.C.; Makide, Y. pp 153-172 of Interpretation of climate and photochemical models, ozone and temperature measurements (La Jolla Institute, 1981). Reck, R.A.; Hummel, J.R. (eds.). New York, NY; American Institute of Physics (1982).

From Workshop on responsible interpretation of atmospheric models and related data; La Jolla, CA, USA (9 Mar 1981).

The atmospheric emissions of CCl_3F_2 have been estimated for 1931 to 1980 by the Chemical Manufacturers Association (CMA). These estimates have been used as the basis for calculations of the expected atmospheric concentrations of CCl_3F_2 after allowance for loss by stratospheric photodissociation alone, and with additional hypothetical tropospheric loss rates. The calculations with the CMA emissions estimates and stratospheric loss alone fail to simulate the data of Rasmussen, et al., by any of three tests: (a) total atmospheric burden of CCl_3F_2; (b) time trend in the relative growth of atmospheric concentrations; and (c) variation with time of the north/south concentration ratio. The inclusion of tropospheric loss processes worsens the agreement. Three other hypothetical emissions estimates for CCl_3F_2 are given which successfully reproduce in each case the atmospheric observations by all three tests. The common characteristics of these hypothetical estimates are: (a) maximum yearly emissions of 500 kilotons or more vs 420.3 kilotons in the CMA estimates; and (b) maximum emissions in 1978 or later vs 1974 in the CMA estimates. No evidence is found in the atmospheric observations for the 20% decrease in CCl_3F_2 emissions since 1974 postulated by CMA. The atmospheric observations are better simulated with CCl_3F_2 emissions during 1976 to 1979 exceeding the CMA values by about 35%, with an increase of 40 to 50% during 1978 to 1979.

41410 **Acid rain.** Lockerby, R.W. Monticello, IL; Vance Bibliographies (1982). 14p. Vance Bibliographies, P.O. Box 229, Monticello, IL 61856 $2.25.

This bibliography contains citations on the environmental and biological effects of acid rain, its chemistry and origin, and economic consequences. (ACR)

41411 **Evaluation of selected aerosol-control measures on flow sorters.** Merrill, J.T. (Lawrence Livermore National Lab., CA). *Cytometry (Baltimore);* 1: No. 5, 342-345(1981). Contract W-7405-ENG-48.

Flow sorters produce microdroplets as part of their normal operation, and if these microdroplets escape into the room, they are potentially hazardous. We have tested several aerosol-control measures on a commercial flow sorter. To accomplish this, T-4 phages were introduced into the sorter's liquid jet through the sample injection tube, and culture plates containing lawns of T-4-sensitive Escherichia coli bacteria were exposed around the sorter for each operational configuration. After the exposure, the plates were incubated and then scored for plaques. A single phage-containing microdroplet landing on a plate was sufficient to cause a plaque of lysed bacteria to form. The number of plaques was thus an indicator of how much aerosol was released for each configuration. Aerosols were controlled most effectively by catching the central, undeflected stream in a vacuum-exhausted tube; this technique, coupled with the manufacturer's vacuum-exhaustion of the air around the sorting location, produced no plaques. Several failure modes were tested, including having the central stream hit the outside of the catch-tube or deflection plates, and loss of the manufacturer's vacuum-exhaustion system. Many flow sorters allow the undeflected stream to splash into a flask or beaker, an approach that produces the most plaques if instrument-failure modes are excluded. The simple addition of a catch-tube removed this major contributor to the aerosol production.

41412 **Environmental effects of acid precipitation.** Duensing, E.E.; Duensing, L.B. Monticello, IL; Vance Bibliographies (1980). 13p. Vance Bibliographies, P.O. Box 229, Monticello, IL 61856 $2.00.

This bibliography attempts to be complete in its coverage of materials published since 1975. All aspects of the effects of acid rain on the environment are included. (ACR)

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 40311, 41408

41413 **(GAT-T—3116) Evaluation of tecniques for controlling UF_6 release clouds in the GAT environmental chamber.** Lux, C.J. (Goodyear Atomic Corp., Piketon, OH (USA)). 1982. Contract AC05-76OR00001. 22p. (CONF-820418—4). NTIS, PC A02/MF A01. Order Number DE82011810.

From UCC-ND and GAT environmental protection seminar; Gatlinburg, TN, USA (5 Apr 1982).

Studies designed to characterize the reaction between UF_6 and atmospheric moisture, evaluate environmental variables of UF_6 cloud formation and ultimate cloud fate, and UF_6 release cloud control procedure have been conducted in the 1200 cu. ft. GAT environmental chamber. In earlier chamber experiments, 30 separate UF_6 release tests indicated that variations of atmospheric conditions and sample sizes had no significant effect on UO_2F_2 particle size distribution, release cloud formation, or cloud settling rates. During the past year, numerous procedures have been evaluated for accelerating UF_6 cloud knockdown in a series of 37 environmental chamber releases. Knockdown procedures included: coarse water spray; air jet; steam spray (electrostatically charged and uncharged); carbon dioxide; Freon-12; fine water mist (uncharged); boric acid mist (charged and uncharged); and an ionized dry air stream. UF_6 hydrolysis cloud settling rates monitored by a laser/powermeter densitometer, indicated the relative effectiveness of various cloud knockdown techniques. Electrostatically charged boric acid/water mist, and electrostatically ionized dry air were both found to be very effective, knocking down the UO_2F_2 release cloud particles in two to five minutes. Work to adapt these knockdown techniques for use under field conditions is continuing, taking into account recovery of the released uranium as well as nuclear criticality constraints.

41414 **(GSF-S—760) Environmental radioactivity and radiation exposure by radioactive emissions of coal-fired power plants.** Jacobi, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). Mar 1981. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82780378.

On the basis of measurements of the radioactive emissions of a 300 MW coal-fired power plant and of a 600 MW lignite-fired power plant the expected activity increase in air and soil in the environment of both plants is estimated and compared with the normal, natural activity level. Due to these emissions it results for the point of maximum immission a committed effective dose equivalent per GW x a of about 0.2 mrem = 0.002 mSv for the coal-fired plant and of about 0.04 mrem = 0.0004 mSv for the lignite-fired plant. This dose is caused to nearly equal parts by inhalation, ingestion and external γ-radiation. The normalized effective dose equivalent in the environment of the modern coal-fired power plant is in the same order of magnitude like that of a modern pressurized water reactor. The total, collective effective dose equivalent commitment by the annual radioactive emissions of coal-fired power plants in the F.R.Germany is estimated to 2000-6000 Man x rem = 20-60 Man x Sv. This corresponds to a mean per caput-dose in the population of the F.R.Germany of about 0.03-0.1 mrem = 0.0003-0.001 mSv; this is about 0.02-0.06% of the mean normal natural radiation exposure of the population.

41415 **(NUREG—0819) Survey of radioactive effluent releases from byproduct material facilities. Technical report.** Cook, J.R. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Aug 1981. 150p. NTIS, PC A07/MF A01.

A survey of over 3,000 NRC byproduct material licensees was conducted in late 1980 to collect data on annual effluent releases of radioactivity. The survey was conducted through a questionnaire, which was sent to NRC licensees who handle radioactive material in unsealed form, i.e., research, medical, and industrial institutions. Principal findings from the survey analysis are as follows: More than 98% of the reported annual releases to air (484 to 490) yield calculated average concentrations at the boundary of the unrestricted area that were at 1% or less than the maximum permissible concentration (MPC) of Appendix B, Table II, Column 1 of 10 CFR 20. The largest reported annual release was estimated to yield a concentration that was approximately 12% of MPC, the 5 other releases ranged from 1 to 10% of MPC. All reported annual releases of liquid waste were within the limits specified by NRC with most facilities reporting annual releases of only a fraction of a curie. Based on the data provided by licensees and analyzed in this report, it appears that in general the environmental impacts from research, medical and industrial institutions and organizations licensed by the NRC to possess and use byproduct materials are minimal and correspond to a small fraction of that from natural background.

41416 **(PB—81-188575) Environmental radioactivity laboratory intercomparison studies program: fiscal year 1980-1981. Interim report 1980-81.** Jarvis, A.B.; Siu, L. (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.). Feb 1981. 24p. (EPA—600/4-81-004). NTIS PC A02/MF A01.

The U.S. Environmental Protection Agency's intercomparison studies program for laboratories involved in environmental radiation measurements is described. The types of environmental samples distributed, the analyses required for each sample, the distribution schedule, and the statistical analysis and reporting of results are discussed. Instructions and application forms are included for laboratories desiring to participate in the program.

41417 **(PB—81-203499) Evaluation and development of procedures for determination of sulfuric acid, total particle-phase acidity and nitric acid in ambient air-phase II. Final report.** Appel, B.R.; Tokiwa, Y.; Hoffer, E.M.; Kothny, E.L.; Haik, M. (California Dept. of Health Services, Berkeley (USA). Air and Industrial Hygiene Lab.). Oct 1980. 100p. NTIS, PC A05/MF A01.

Selective extraction of H_2SO_4 with benzaldehyde and titrimetry for strong acids were compared in atmospheric trials. Gaseous nitric acid was determined by (1) measuring the nitrate collected on nylon or NaCl-impregnated cellulose filters after removal of particulate matter with Teflon prefilters, and (2) the difference between total inorganic nitrate (TIN) and particulate nitrate (PN). TIN was measured by the sum of the nitrate collected with a Teflon prefilter and nylon or NaCl-impregnated after-filter, and PN, by the nitrate able to penetrate a diffusion denuder coated to remove acidic gases. The atmospheric HNO_3 results were also compared to those by Fourier Transform Infrared Spectroscopy. A modified chemiluminescent NOx monitor converted to measure nitric acid continuously, was compared to the filter techniques in laboratory trials. Levels of H_2SO_4 up to 11 micrograms/cu. m were observed in California's South Coast Air Basin (SCAB) using selective extraction with benzaldehyde. HNO_3 appeared to contribute to the particulate acidity together with the H_2SO_4. Gaseous nitric acid measurements using nylon or NaCl-impregnated after-filters were substantially higher than those by the difference technique. This correlated with losses of nitrate from the Teflon prefilters, which exceeded 50% at high ambient temperature and low relative humidity. Gelman A glass fiber filters retained essentially all the gaseous nitric acid sampled.

41418 **A continuous release formulation for environmental doses to moving recorders.** Piepho, M.G. (Westinghouse Hanford, Richland, WA 99352). *Transactions of the American Nuclear Society;* **38**: 107-108(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41419 **Anemos: a code to calculate radionuclide concentrations in air.** Hermann, O.W.; Miller, C.W. (ORNL). *Transactions of the American Nuclear Society;* **38**: 97-98(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

5004 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 41347, 41348

5005 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 40156

5006 Regulations

REFER ALSO TO CITATION(S) 40175, 40204, 41077

41420 **(PB—81-182024) The response to state and local regulations on emissions to the atmosphere. Final report.** (Environmental Law Inst., Washington, DC (USA)). 6 Apr 1979. 257p. NTIS PC A12/MF A01.

This report covers the first of three tasks in a study of the effectiveness of direct regulation of hydrocarbon, sulfur oxide, and total suspended particulate emissions from stationary sources in New Jersey with respect to establishing, achieving, and maintaining continuous compliance with emission limitations and other requirements geared to attaining and maintaining ambient air quality standards; the study includes cost effectiveness. The first task describes the regulatory process for sources of these pollutants and selects 20-30 individual stationary sources to be studied in depth in the second task.

41421 **(PB—81-235046) Policy issues papers: six papers on controlled trading.** Bush, J.; Carson, B.; Lyders, J.; Weiss, M.; Foster, D. (Environmental Protection Agency, Washington, DC (USA)). Aug 1981. 100p. (EPA—230/3-81-004). NTIS, PC A05/MF A01.

Contents: Emission allocation - a tool for air quality planning and implementation of reasonable further progress; An emission offset and banking regulation for the Puget Sound Region; The Puget Sound emissions banking experience; Emission reductions from shutdowns - Their role in banking and trading systems; The potential of generating emission reduction credits from solar and energy conservation under innovative reforms in air pollution control; Indirect offsets - A supplemental program to facilitate interfirm trades in emission reductions.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

41422 **X/gamma-ray measurements of total activity in environmental samples without prior knowledge of isotopic abundance.** Strauss, M.G.; Sherman, I.S. (Argonne National Lab., IL (USA)); Pehl, R.H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Instruments and Methods in Physics Research;* **193**: No. 1/2, 203-208(15 Feb 1982).

From 5. symposium on x- and gamma-ray sources and applications; Ann Arbor, MI, USA (10 - 12 Jun 1981).

The assay of transuranics in environmental samples by L X-ray spectrometry has al basic limitation. Since X-rays characterize the elements and not the isotopes, the total α-activity of the parent elements cannot be determined without prior knowledge of the isotopic composition. This limitation can usually be overcome by also measuring the weak intensity, low-energy (35-50 keV) γ-rays emitted in the parent decay. Although the statistical uncertainty in such measurements can be high, the uncertainty in the total activity as determined from L X-ray measurements, is much lower as a result of what we call the Peter-Paul effect. A soil sample from Rocky Flats containing 70 pCi/gsup(239,240)Pu with $^{240}Pu/^{239}Pu$ approx. equal to 0.1 was measured with our Si(Li)-NaI(Tl) prototype X/γ-ray spectrometer. The results are in good agreement with radiochemical analysis.

41423 **Response of steppe shrubs to the 1977 drought.** Rickard, W.H.; Warren, J.L. (Pacific Northwest Lab., Richland, WA). *Northwest Science;* **55**: No. 2, 108-112(1981). Contract AC06-RLO1830.

Litterfall collecting is a non-destructive and efficient way to monitor the leaf growth of steppe shrubs over extended periods of time. During the 1977 growing season, the shrub steppe region experienced severe drought. Shrubs responded by producing few leaves, resulting in less litterfall. In some areas, spiny hopsage did not produce leaves at all. The drought was broken in 1978: sagebrush, bitterbrush, spiny hopsage, and greasewood produced as much or more litterfall as they did in the 1976 growing season.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 40236, 40716, 41410, 41412, 41439

41424 **(DOE/EV/10725—1) Prospective significance of temperate-zone carbon pool transients, 1980-2010.** Armentano, T.V.; Loucks, O.L. (Institute of Ecology, Indianapolis, IN (USA)). 1981. Contract AC02-81EV10725. 34p. NTIS, PC A03/MF A01. Order Number DE82011866.

The extent to which the temperate zone sink for carbon will be limited by increased forest utilization is a major question for biospheric carbon balances over the next two decades. Over the past 100 years, shifts in global carbon pools have operated asynchronously, with carbon storage at any time dependent on the net difference between opposing fluxes. Overall, however, the regrowth and soil sequestering transients of the last 60 years in the temperate zone have tended to balance releases of carbon from other sources. Increased utilization of forests and other biospheric pools for fibre and energy, however, may bring about similar responses worldwide with the temperate zone behaving more as a source of carbon dioxide. Analysis shows that the net carbon increment in US forests could be greatly reduced or eliminated in 20 to 30 years if an annual harvest rate of wood equivalent to 10 quads of energy prevails. The increment would be lost even if complete use

of logging and manufacturing residues were attained. Without complete residue utilization for energy, the carbon increment would be depleted more rapidly. Forest loss patterns in other temperate zone countries appear to be following similar trends.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 40282, 40833, 41416

41425 **(NUREG/CR—1658) The environmental behavior of transuranic nuclides released from water cooled nuclear power plants. Final report, 1 August 1977-31 December 1978.** Bowen, V.T. (Woods Hole Oceanographic Institution, MA (USA)). Mar 1981. 63p. NTIS PC A04/MF A01.

Release data are reported for three coastal water-cooled nuclear reactors: Millstone Point No. 1 and No. 2 (for the period January 1977 through April 1978), and Maine Yankee (for the period 20 June 1977 through 25 March 1978); release samples were analyzed for (55)Fe, (60)Co, (134)Cs, (137)Cs, (238)Pu, (239), (240)Pu, (241)Am, (242)Cm and (244)Cm, but not all nuclides on every sample. Radioiron is a major component of the releases measured; the transuranium nuclides are less significant components than was expected, but levels have occasionally reached microcuries per month. Pulses of this size are adequate for tracer studies. Environmental samples (water, sediments, and biota) have been analyzed from about the two reactor sites noted, and that of the Pilgrim No. 1 reactor. No water samples remote from reactor outflows have unequivocally shown reactor contamination. No sediment samples from near Millstone Point or Pilgrim 1 have shown reactor contamination; this has been clearly evident in several sediment collections from near Main Yankee.

41426 **(ORNL/TM—8138) Soil radiochromatography using ^{22}Na, ^{85}Sr, and ^{58}Co.** Spalding, B.P.; Hoffman, W.A. Jr. (Oak Ridge National Lab., TN (USA)). Mar 1982. Contract W-7405-ENG-26. 43p. NTIS, PC A03/MF A01. Order Number DE82009608.

A laboratory study of radionuclide movement and adsorption in soil has been performed. A commercial, high-performance, liquid chromatography system, employing an ultraviolet adsorption detector, was supplemented with a real-time radiation monitor of the column effluent. Columns packed with various soils and their size separates were injected with ^{22}Na, ^{85}Sr, and ^{58}Co using various $CaCl_2$ solutions for eluting solvents to simulate groundwater. The near identical behavior of ^{85}Sr and Ca allowed the elution volumes of the Sr peaks to be used for the calculation of the cation retention capacities of the soils which agreed with their measured cation exchange capacities. Treatment with NaOH increased the cation exchange capacity of one column by 50%. Acetone or sodium benzoate proved useful for measuring column void volumes using the ultraviolet detector because they eluted at exactly the calculated void volumes for all soil columns. Methods to measure a soil's retardation factor (R/sub d/) and distribution coefficient (K/sub d/) for each isotope from the experimental elution patterns were developed. Excellent simulations of the elution peaks were attained using the Lapidus-Amundson equation, which required inputs of flow rate, K/sub d/, bulk density, porosity, the dispersion coefficient, and column length. The factors determining the elution volume of either ^{22}Na or ^{85}Sr were the cation exchange capacity of the column and the concentration of Ca in the eluting solution. Elution of these isotopes was not affected by the presence of complexing organic acids, EDTA, or acidic and basic soil organic matter extracts. On the other hand, ^{58}Co exhibited enhanced mobility when complexed with EDTA but not with other organic acids or soil extracts. A significant amount of ^{58}Co was strongly adsorbed by the soils and could be removed only by washing with strong mineral acid.

41427 **(PB—82-103151) Technical assistance report no. TA-80-105-757 at Lexington Herald-Leader, Lexington, Kentucky.** Murray, W.E.; Conover, D.L.; Flesch, J.P. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Oct 1980. 10p. NTIS, PC A02/MF A01.

Exposure to radiation was investigated at the Lexington Herald-Leader newspaper company (SIC-2711) in Lexington, Kentucky, on August 12 and 13, 1980. The evaluation was requested by company management. Thirty-five of 60 to 80 video display terminals (VDT) used by the newspaper were randomly selected and the ionizing and non-ionizing radiation emissions were measured. All VDT radiation measurements were below OSHA standards and, often, below detectable levels. The OSHA ionizing and non-ionizing standards are 2.5 millirems per hour averaged on a daily basis and 1.0 milliwatt per square centimeter averaged over 6 months, respectively. The authors conclude that no radiation hazard exists at the Lexington Herald-Leader.

41428 **(NUREG—0837-Vol.1-No.3-4) NRC TLD direct radiation-monitoring network. Progress report, July-December 1981.** Costello, F.; Thompson, T.; Cohen, L. (Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I). May 1982. 174p. GPO, $7.00.

This report is part of a continuous series providing data from the NRC's Thermoluminescent Dosimeter (TLD) Direct Radiation Monitoring Network. This report presents data for the third and fourth quarters of 1981. The network is operated by the NRC in cooperation with participating states. The report presents the radiation exposure levels measured in the vicinities of NRC-licensed facilities throughout the country and includes facilities under construction, as well as those which are in operation. Each site is monitored by approximately 40 TLD stations located in concentric rings. A complete description of the program can be found in NUREG-0837, Volume 1, Numbers 1 and 2.

41429 **Environmental aspects of radioactivity.** Richmond, C.R. (ORNL). *Transactions of the American Nuclear Society;* **38**: 3-4(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41430 **Numerical investigation of radon transport through a porous medium.** Roberts, C.J.; Yuan, Y.C. (Argonne National Laboratory, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **38**: 108-110(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41431 **Predicting radionuclide leaching from root zone soil for assessment applications.** Baes, C.F. III; Sharp, R.D. (ORNL, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **38**: 111-112(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 40202, 40293, 40311, 41730, 41731

41432 **(PB—81-196321) Site inventories and early site review: a survey of state experience with site inventories and early site review for energy facility sites. Final report.** Messing, M. (Environmental Policy Inst., Washington, DC (USA)). Mar 1980. 160p. NTIS, PC A08/MF A01.

This survey of energy facility siting in the 50 States covers the following topics: state siting laws, state site surveys, need for powerplant sites, long-range electric planning, and early federal site reviews.

41433 **(TAC-RS—82-001) Quarterly literature review of the remote sensing of natural resources. First quarter, January-March 1982.** (New Mexico Univ., Albuquerque (USA). Technology Application Center). Mar 1982. 131p. Technology Application Center, Univ. of New Mexico, Albuquerque, NM 87131.

Portions of document are illegible.

The first quarter of Remote Sensing of Natural Resources contains approximately 400 abstracts and citations. Most of the documentation is contained within the sections of geology and hydrology, with a significant increase of abstracts in the geology section,

and a notable decrease of documentation in the data manipulation section. Documentation pertaining to meteorology and extraterrestrial sensing are not selected for this literature review. Sensors are primarily those operating within the ultraviolet through radar wavelength bands. Following the Information Sources description, are recent releases and upcoming events. Included this quarter are services performed by TAC, an update of the ASP Technical Calender, and information pertaining to the Geographic Information Analysis Workshops given by Joseph L. Berry of Yale University.

41434 **(TVA/PUB—82/4) Developing resource overlays for regional recreation planning: the smokies experience.** Morton, J.A.; Spangler, J.W. (Tennessee Valley Authority, Norris (USA). Div. of Forestry, Fisheries and Wildlife Development). Mar 1977. 30p. (TN-B—23). NTIS, PC A03/MF A01. Order Number DE82901244.

Use of resource overlays is described as they were developed and demonstrated in connection with regional recreation planning during work group sessions of the Great Smokies Regional Planning Team. By superimposing resource map overlays on base maps, participants were able to consider potential development opportunities and land-use conflicts effectively and objectively.

5106 Regulations

REFER ALSO TO CITATION(S) 40272, 40322

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 41349, 41462, 41463, 41464, 41465, 41466, 41468, 41557

41435 **(DOE/EV/00936—6) Biological processes in the water column of the South Atlantic Bight. Progress report, June 1979-June 1982.** Paffenhofer, G.A.; Yoder, J.A. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 21 Dec 1981. Contract AS09-76EV00936. 21p. NTIS, PC A02/MF A01. Order Number DE82011540.

Research progress from June 1979 to June 1981 is summarized. Investigations included phytoplankton dynamics in relation to periodic upwelling associated with disturbances of the Gulf Stream cyclonic front, a determination of abundance and distribution of nutrients, phyto- and zooplankton in upwelled water, and a determination of the frequency and size of upwelled water masses. (ACR)

41436 **(DOE/EV/01599—202) Technical progress report, 1 January 1981-31 December 1981.** Wetzel, R.G. (Michigan State Univ., East Lansing (USA)). 1982. Contract AC02-76EV01599. 46p. NTIS, PC A03/MF A01. Order Number DE82008785.

These investigations focus on integrated studies of the qualitative and quantitative cycling and metabolism of particulate and dissolved organic carbon in lakes and their inflow sources (surface and subsurface). Emphasis is placed on the sources, fates, and interactions of dissolved and particulate organic matter in relation to: (a) inorganic chemical cycling, (b) allochthonous loading to the lake system, (c) the coupled nutrient physiology and metabolism of phytoplankton, bacterial populations, macrophytes, and attendant sessile algal-bacterial communities. Regulatory mechanisms of growth and rates of carbon and nutrient cycling are being evaluated among the (a) inorganic-organic influxes of allochthonous sources as they are controlled by wetland-littoral communities, (b) the littoral photosynthetic producer-decomposer complex, and (c) the microflora of the pelagial zone.

41437 **Sediment trap experiments in the deep north Atlantic: isotopic and elemental fluxes.** Brewer, P.G. (Woods Hole Oceanographic Institution, MA); Nozaki, Y.; Spencer, D.W.; Fleer, A.P. *Journal of Marine Research;* **38**: No. 4, 703-728(1980).

Sediment trap experiments have been carried out at sites in the Sargasso Sea (S_2) and in the Atlantic off Barbados (E) to determine the mass flux and chemical composition of material sinking to the sea floor. At the S_2 site, the mass flux increases with depth, at the E site the flux is constant. Chemical analyses show that K, Ti, Al, La, V, Co and ^{232}Th are derived largely from terrigenous materials whereas Ca, Sr, Mg, Si, Ba, ^{230}Ra, U and I are carried by biogenic particles. The reactive elements Mn, Cu, Fe, Sc, and ^{230} ^{234}Th, show increasing ratios to Al with depth due to scavenging from the water column. A mean particle settling velocity of 21 m day^{-1} and scavenging residence times ranging from 22 years for Th to 500 years for Cu have been calculated. The flux of aluminosilicates increases with depth, and this cannot be attributed to changes in trap efficiency. Thus horizontal transport of material must be invoked.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 40201, 40226, 40228, 40229, 40230, 40231, 40232, 40233, 40234, 40235, 40237, 40238, 40239, 40716, 41410, 41412, 41455, 41460

41438 **(CED—82-37) New approach is needed for the Federal industrial-wastewater pretreatment program. Report to the Administrator, Environmental Protection Agency.** (General Accounting Office, Washington, DC (USA). Community and Economic Development Div.). 19 Feb 1982. 19p. General Accounting Office, PO Box 6015, Gaithersburg, MD 20760.

Federal efforts to implement a Federal industrial wastewater pretreatment program have been surrounded by controversy and have generated considerable uncertainty and confusion. It is highly unlikely that the program can be implemented within the existing time frames. The General Accounting Office recommends that the Administrator provide certain information to the Congress on toxic pollution problems and issues.

41439 **(DOE/EV/10257—1) Migration of petroleum products accidentally introduced into the subsurface through spills.** Abriola, L.M.; Pinder, G.F. (Princeton Univ., NJ (USA)). 1982. Contract AC02-79EV10257. 54p. NTIS, PC A04/MF A01. Order Number DE82008877.

A discussion and assessment are presented of the important phenomena governing the infiltration and migration of petroleum products in the subsurface as gleaned from laboratory and field studies. The information is analyzed with a view towards incorporating these phenomena into a mathematical model. Such model would serve as a valuable planning and predictive tool by tracing future oil migration and simulating the effects of various remedial schemes. Discussed are the influences of gravity, capillary forces, solubility, and evaporation. Natural influences serving to retard the migration such as adsorption onto soil particles and biodegradation by soil microorganisms are also covered. (DMC)

41440 **(DOE/NBM—2010246) Proceedings of the bi-state conference on the Chesapeake Bay, April 27-29, 1977. CRC Publication No. 61.** (Chesapeake Research Consortium, Inc., Baltimore, MD (USA)). Oct 1977. Contract EE-77-G-01-6109. 310p. NTIS, PC A14/MF A01. Order Number DE82010246.

The conference included discussions on the following subject areas: the condition of the Chesapeake Bay; maritime developments; toxic substances; prevention and control of spills; fisheries and wildlife; and non-point pollution. (ACR)

41441 **(K/TL/AT—98) Organic priority pollutants in wastewater.** McMahon, L.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Mar 1982. Contract W-7405-ENG-26. 31p. (CONF-820418—8). NTIS, PC A03/MF A01. Order Number DE82008326.

From UCC-ND and GAT environmental protection seminar; Gatlinburg, TN, USA (5 Apr 1982).

Prior to June 1978, a collection of environmentally concerned groups brought suit against the Environmental Protection Agency (EPA) for failing to implement portions of the Federal

Water Pollution Control Act (FWPCA). The court decision, which has commonly become known as the EPA Consent Decree, required the EPA to publish a list of toxic pollutants to be controlled, discharge limitations for those compounds in water effluents, and methods for quantating those compounds. Of the 129 compounds since designated as priority pollutants by the EPA, 114 are organic compounds. The gas chromatography/mass spectrometry methods of analysis, as proposed by the EPA (methods 624 and 625), have been applied to wastewater from the Oak Ridge Gaseous Diffusion Plant (ORGDP). All toxic pollutants identified in the ORGDP wastewater are from the volatile fraction. The concentrations of these organic pollutants range from <10 ppB to ~ 2 ppM.

41442 **(PB—81-202079) Contaminant transport in hydrogeologic systems. Technical report 1 Oct 78-31 Mar 81.** Chen, C.; Reddell, D.L. (Texas A and M Univ., College Station (USA). Water Resources Inst.). Mar 1981. 130p. NTIS, PC A07/MF A01.

The transportation process of a specific conservative ion species is analogous to transport of heat in the system. Analytical models of hot water injection into groundwater aquifers were developed. Two models were developed to examine the influence of a caprock of finite thickness on the thermal response of an aquifer. A graphical technique was developed to determine four pertinent aquifer thermal properties. The caprock thickness was found to influence aquifer temperature distribution only when the time after injection is long.

41443 **(PB—81-241655) Regional oil and hazardous substances pollution contingency plan: Region 5 inland.** Madany, G.H. (Environmental Protection Agency, Chicago, IL (USA). Region V). May 1981. 186p. NTIS, PC A09/MF A01.

This plan, including the annexes, provides for a pattern of coordinated and integrated response by departments and agencies of the federal government to protect the environment from the damaging effects of pollution discharges. It promotes the coordination and direction of federal, state, and local response systems and encourages the development of local government and private capabilities to handle discharges.

41444 **(PB—81-244717) Disequilibrium of hydrogen sulfide in ground water by aeration. Final report.** Ritchey, J.D. (National Water Well Association, Worthington, OH (USA); National Science Foundation, Washington, DC (USA)). 24 Apr 1981. 119p. NTIS, PC A06/MF A01.

This study examines removal of hydrogen sulfide gas by aeration as a result of bubbling air through water in the well before it is pumped out of the ground. The field study demonstrated that a substantial amount of hydrogen sulfide gas could be successfully removed by the method tested. Evaluation of water analyses indicated three processes that caused reduction in the concentration of hydrogen sulfide gas: (1) hydrogen sulfide gas was released from water to air by gas transfer--indicated by a strong 'rotten egg odor,' characteristic of hydrogen sulfide gas that was emitted from the wellhead; (2) hydrogen sulfide gas was oxidized to elemental sulfur--evidenced by an increase in dissolved oxygen measured in water samples and by clouding of pumped water; and (3) hydrogen sulfide gas was partially ionized--indicated by an increase in the pH and the redox potential of water samples. This field study demonstrates that in-well aeration is an effective method of hydrogen sulfide gas removal in domestic wells with potential application in larger installations.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 41416, 41425

41445 **In situ tritium borehole probe for measurement of tritium.** Dotson, D.W.; Mikesell, J.L.; Senftle, F.E. US Patent Application 200,110. [nd]. Filed date 24 Oct 1980. 10p.

One of the radioactive waste products from nuclear power production is tritium or radioactive hydrogen of mass number 3. The release of radioactive waste products into rivers and streams introduces this tritium into the environment. Public and private agencies involved with nuclear regulation, the protection of the environment, and the study of water resources are concerned with the levels of tritium in our water supply. Presently, the technique for determining tritium levels in water is performed in the laboratory by first purifying the sample of obtained water and then releasing the tritium by electrolysis. Another technique employs calcium carbide to generate actylene gas from the water sample. The presently disclosed invention makes the separation at the sample site and incorporates the water purification previously done into one process.

41446 **(NP—2903396) Radioactivity in surface and coastal waters of the British Isles, 1977: aquatic environment monitoring report No. 3.** Hunt, G.J. (Ministry of Agriculture, Fisheries and Food, Lowestoft (UK). Directorate of Fisheries Research). 1979. 41p. Fisheries Radiological Laboratory, Lowestoft, England.

Portions of document are illegible.

This report presents the 1977 results of the environmental monitoring programme carried out by the Fisheries Radiobiological Laboratory (FRL) as part of this Ministry's responsibilities under the Radioactive Substances Act, 1960. This program is set up to verify the satisfactory control of liquid radioactive waste discharges to the aquatic environment, and to ensure that the resulting public radiation exposure is within nationally-accepted limits. The monitoring is independent of often similar programmes carried out by nuclear site operators as a condition of their authorizations to discharge radioactive wastes. This report also includes results of monitoring carried out on behalf of departments of the Scottish Office, the Department of the Environment for Northern Ireland, the Channel Island States and the Republic of Ireland. Where appropriate, the information presented is supplemented by results from FRL's extensive programme of research into the behavior of radioactivity in the aquatic environment. To set the monitoring results in proper context, liquid radioactive discharges from UK nuclear establishments to the aquatic environment in 1977 are first summarized. Before exposition of the monitoring results, an explanatory section gives details of how the results are presented and interpreted in terms of public radiation exposures.

41447 **(NUREG—0754) Impact of the 1979 accident at Three Mile Island Nuclear Station on recreational fishing in the Susquehanna River. Technical report.** Hickey, C.R. Jr. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Mar 1981. 43p. NTIS PC A03/MF A01.

Dynamics of the recreational fishery of the Susquehanna River near Three Mile Island Nuclear Station during the postaccident year of 1979 are compared with those of the 5-year preaccident period 1974-1978. Monthly and annual fishing effort essentially was normal during 1979. Harvests and indices of harvest success were at record low levels for 5 months (and on an annual basis) after the accident. The monthly harvest indices gradually improved with time until normal levels were attained during the sixth postaccident month (September).

41448 **A comparison of three aquatic-food models for estimating meltdown consequences.** Niemczyk, S.J. (Sandia, Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **38**: 110-111(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41449 **Effects of source-fissile material distributions on the accuracy of time-correlated counting.** Cannon, J.W. (EG&G Idaho, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **38**: 178-179(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41450 **Natural radionuclides in waters of the New York Bight.** Li, Y.H. (Columbia Univ., Palisades, NY); Santschi, P.H.; Kaufman, A.; Benninger, L.K.; Feely, H.W. *Earth and Planetary Science Letters;* **55**: 217-228(1981). Contract EY-S-02-2185.

The half removal time of ^{228}Th from the surface waters by settling particles, t/sub c/, does not change much with season, except in the winter when regenerated ^{228}Th, as well as ^{210}Pb and ^{210}Po were transported back to the surface water from the bottom water and/or near-shore sediments. The removal of ^{228}Th and ^{210}Pb from the surface waters of New York Bight by phytoplankton-zooplankton-fecal pellet route is not important in the shelf but is important in the slope areas. The removal of ^{210}Po is almost entirely associated with the phytoplankton-zooplankton-fecal pellet pathway throughout the New York Bight.

41451 **Direct determination of ^{7}Be in sediments.** Larsen, I.L.; Cutshall, N.H. (Oak Ridge National Lab., TN). *Earth and Planetary Science Letters;* **54**: 379-384(1981). Contract W-7405-ENG-26.

Cosmic-ray produced ^{7}Be (53 days half-life) is directly measurable in freshly collected samples of river and coastal zone sediments using a lithium-drifted germanium detector. Calibration of the detector is discussed and an assessment of overall accuracy and sensitivity presented. The detection limit for a 250-g dry weight sediment sample contained in a Marinelli Beaker and counted for 200 minutes is approximately 0.4 pCi/g. Applications toward locating zones of rapid sedimentation as well as in understanding shallow-water sedimentation dynamics are suggested.

5204 Thermal Effluents Monitoring And Transport

41452 **(GKSS—80/E/44) Analysis of thermal impact in tidal rivers and estuaries.** Haeuser, J.; Eppel, D.; Tanzer, F. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1980. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82780379.

The paper presents a far field mathematical model for numerical simulation of transient one or two-dimensional thermal distributions in regions with severe reversing flow conditions. The Eulerian formulation employs the integral form of the conservation principles for mass and thermal energy. The two-dimensional (2 D) solution area is spanned by discrete elements of variable size and shape. The three-dimensional geometry of the flow region is accounted for by spatially intergrating over the enclosure surfaces of the discrete element. The derivation of the two-dimensional depth-averaged temperatur equations includes the constributions of the vertical variations of velocity and temperature. Surface heat transfer as well as turbulent effects are taken into account. Important mathematical and computational features of the model are summarized. There is a discussion of the four main algorithms, necessary to treat flow regions with complex shoreline geometries, viz. (i) specification of the boundary (ii) determination of all discrete element midpoints lying within the (possibly multiconnected) solution area (iii) construction of discrete elements of irregular geometry exactly matching the (curved) boundary, (iv) treatment of boundary condiditons and numerical solution of the resulting mathematical system of weakly coupled, ordinary differential equations derived from the conservation principles. Preliminary results of a computer simulation are compared with the available data for a section of the Lower Elbe river. The calculation of the two-dimensional temperature distribution includes existing power plants and industrial sites.

41453 **(NUREG/CR—1939-V2) Ecological studies of wood-boring bivalves in the vicinity of the Oyster Creek Nuclear Generating Station. Quarterly progress report 1 Dec 80-28 Feb 81.** Hoagland, K.E.; Crocket, L. (Lehigh Univ., Stone Harbor, NJ (USA). Wetlands Inst.). Aug 1981. 49p. NTIS, PC A03/MF A01.

The species composition, distribution, and population dynamics of wood-boring bivalves are being studied in the vicinity of the Oyster Creek Nuclear Generating Station, Barnegat Bay, New Jersey. Untreated wood test panels are used to collect organisms at 12 stations. Physiological tolerances of 3 species are also under investigation in the laboratory. Relative destructiveness and competition among the species are being analyzed. The native species Teredo navalis and Bankia gouldi coexist with the introduced T. bartschi in Oyster Creek and at the mouth of Forked River. An increase in mortality occurred in January. By February, Teredo bartschi was found only at Bayside.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 40223, 40302, 40310, 41724

41454 **(PB—81-199093) A preliminary evaluation of the occurrence and characteristics of cut-off ponds of the Maryland shores of the Chesapeake Bay.** (Otto (R.G.) and Associates, Baltimore, MD (USA)). Oct 1980. 23p. NTIS, PC A02/MF A01.

Under the auspices of the Maryland Power Plant Siting Program, a preliminary investigation of occurrence and characteristics of cut-off ponds in the Maryland portion of the Chesapeake Bay was conducted. These small ponds occur commonly along the Bay shore. A sand berm separates the freshwaters of the ponds from the saline waters of the Bay; this berm is occasionally breached permitting interchange between ponds and Bay. A survey of aerial maps and photographs has revealed approximately 1800 ponds bordering the mid and upper Bay.

41455 **(PB—82-109026) Water - today and tomorrow. Volume I: program summary.** (Pacific Northwest River Basins Commission, Vancouver, WA (USA)). 1980. 19p. NTIS, PC A02/MF A01.

The report summarizes the regional water resources management plan for the Pacific Northwest River Basins.

41456 **(PB—82-111980) Water quality management program for Rawhide Energy Project cooling impoundment. Final report.** Lee, G.F.; Jones, R.A. (Colorado State Univ., Fort Collins (USA). Dept. of Civil Engineering). Sep 1980. 116p. NTIS, PC A06/MF A01.

The Platte River Power Authority is building a 279MW electric generating station near Fort Collins, CO., the make-up water for its cooling reservoir will be principally the secondary treated domestic wastewater from Fort Collins. The power authority was concerned about the quality of the water and the additional treatment that would have to be provided for the make-up water because it wished to open the reservoir for public recreation involving boating, fishing, and other non-contact water oriented activities. Based on the information provided on the expected physical characteristics of the water-body and its watershed, the chemical characteristics of the city's domestic wastewater treatment plant effluent, and water usage patterns, sufficient information was generated to apply the OECD eutrophication modelling approach to the proposed reservoir.

5206 Regulations

REFER ALSO TO CITATION(S) 40868, 41446

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 40869

41457 **(PB—81-133662) Water as a parameter for development of energy resources in the Upper Great Plains: socio-economic effects of alternative patterns of coal-based energy development.** Toman, N.E.; Dalsted, N.L.; Wieland, J.S.; Leistritz, F.L. (North Dakota State Univ., Fargo (USA). Agricultural Experiment Station). Dec 1978. 152p. NTIS, PC A08/MF A01.

Analysis of the effects of alternative patterns of coal-based energy development in the Upper Great Plains on resource use, economic activity, and population distribution in the region are discussed. The report addressed the effects on economic activity, population growth and settlement patterns, and the costs and revenues to State and local levels of government of coal development in the region.

41458 **(PB—81-183840) The effectiveness of the 55 mph national maximum speed limit as a life saving benefit. executive summary. Technical report.** Johnson, P.; Klein, T.M.; Levy, P.; Maxwell, D. (National Highway Traffic Safety Administration, Washington, DC (USA). Office of State Vehicle Programs). Jan 1981. 15p. (DOT-HS—805811). NTIS PC A02/MF A01.

The following report contains an analysis of the life saving benefits resulting from the 55 mph NMSL from 1974-1979. Monthly fatality data from 1970-1979 was used in a time series model to arrive at the estimated safety benefits (lives saved). The time series model relates changes in monthly fatalities to changes in monthly vehicle miles traveled, introduction of safety improvements and the implementation of the 55 mph NMSL law. Increases in highway fatalities in 1976-1979 compared to the 1974-1975 level led to a detailed examination and analysis of the composition of these fatalities in order to determine possible causes for the increases. Based upon the available data, it was concluded that 55 mph compliance had eroded somewhat in 1977 and 1978 thus resulting in some fatality increases.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 40896, 40897

41459 **(PB—81-133670) Water as a parameter for development of energy resources in the Upper Great Plains: effects on land and water resources of alternative patterns of coal-based energy development.** Scott, D.F.; Pfeiffer, G.H.; Gronhovd, D.E. (North Dakota State Univ., Fargo (USA). Agricultural Experiment Station). Dec 1978. 38p. NTIS, PC A03/MF A01.

This report represents Volume II of a two-volume study report on the analysis of the effects of alternative patterns of coal-based energy development in the Upper Great Plains on resource use, economic activity, and population distribution in the region. It presented a detailed analysis of mined land reclamation costs in North Dakota (along with costs for selected mine sites in Montana and Wyoming); identified existing surface water supplies and use in the region; discussed the impacts of alternative levels of coal development on water resources.

41460 **(PB—81-801656) Water pollution in estuaries and coastal zones. 1978-December 1980 (citations from the NTIS Data Base). Report for 1978-December 1980.** Brown, R.J. (National Technical Information Service, Springfield, VA (USA)). Jan 1981. 118p. NTIS PC N01/MF N01.

The bibliography contains selected abstracts of research reports covering studies dealing with water pollution from estuarine and coastal development, the effects of this pollution, and its control. The reports are general in nature so as to be of interest to any coastal area. The topics include pollution as related to urbanization, government actions, coastal planning, natural resource development, and sewage and solid waste disposal. Specific biological and oceanographic studies have been excluded. (This updated bibliography contains 112 citations, 42 of which are new entries to the previous edition.)

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 40223, 40228, 40231, 40232, 40234

41461 **(NUREG—0854) Final environmental statement related to the operation of Clinton Power Station, Unit No. 1. Docket No. 50-461.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). May 1982. 228p. GPO $7.00.

Portions of document are illegible.

This final environmental statement contains the second assessment of the environmental impact associated with operation of Clinton Power Station Unit 1 pursuant to the National Environmental Policy Act of 1969 (NEPA) and 10 CFR Part 51, as amended, of the NRC's regulations. This statement examines: the affected environment, environmental consequences and mitigating actions, and environmental and economic benefits and costs. Land-use, terrestrial- and aquatic-ecological impacts, and air-quality impacts will be small. Steam fog from the station's cooling lake has the potential for reducing visibility over nearby roads and bridges. A fog-monitoring program for nearby roads and bridges has been recommended. Impacts to historic and prehistoric sites will be negligible. Chemical discharges to Lake Clinton and Salt Creek are expected to have no appreciable impacts on water quality under normal conditions and will be required to meet conditions of the station's NPDES permit. The hydrothermal analyses indicate that under certain meteorological conditions (1-in-50-year drought), the plant would have to be operated at reduced power levels in order to meet the thermal standards established by the Illinois Pollution Control Board Order PCB 81-82. The effects of routine operations, energy transmission, and periodic maintenance of rights-of-way and transmission line facilities should not jeopardize any populations of endangered or threatened species. No significant impacts are anticipated from normal operational releases of radioactivity. The risk associated with accidental radiation exposure is very low. Contentions associated with environmental issues accepted during the operating-license hearing are related to assessment of effects of low-level radiation. The net socioeconomic effects of the project will be beneficial. The action called for is the issuance of an operating license for Unit 1 of Clinton.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

41462 **(PB—81-243271) Characterization of marine mammals and turtles in the mid- and north-Atlantic areas of the US Outer Continental Shelf: executive summary for 1979. Final report 1979-81.** (Rhode Island Univ., Kingston (USA); Bureau of Land Management, Washington, DC (USA)). Apr 1981. 79p. NTIS, PC A05/MF A01.

The program's objectives are as follows: (1) to determine which species of marine mammals and marine turtles inhabit and/or migrate through the study area; (2) to identify, delineate and describe areas of importance (feeding, breeding, calving, etc.) to marine mammals and marine turtles in the study area; (3) to determine the temporal and spatial distribution of marine mammals and marine turtles in the study area; (4) to estimate the size of and extent of marine mammal and marine turtle populations in the study area; and (5) to emphasize the above item 1-4 for those species classified as threatened or endangered by the Department of Interior and Department of Commerce.

41463 **(PB—81-248171) Summary of marine mammal and seabird surveys of the Southern California Bight area, 1975-1978. Volume III - investigators' reports. Part I - pinnipeds of the Southern California Bight. Final report.** Bonnell, M.L.; Le Boeuf, B.J.; Pierson, M.O.; Dettman, D.H.; Farrens, G.D. (California Univ., Santa Cruz (USA); Bureau of Land Management, Washington, DC (USA)). Apr 1981. 557p. NTIS, PC A24/MF A01.

This volume contains the findings of a three year study of the Pinnipedia of the Southern California Bight area. The distribution, abundance, movements, seasonality and reproductive status of the pinnipedia of the SBC area are discussed.

41464 **(PB—81-248189) Summary of marine mammal and seabird surveys of the Southern California Bight area, 1975-1978. Volume III - investigators' reports. Part II - cetacea of the Southern California Bight. Final report.** Dohl, T.P.; Norris, K.S.; Guess, R.C.; Bryant, J.D.; Honig, M.W. (California Univ., Santa Cruz (USA); Bureau of Land Management, Washington, DC (USA)). Apr 1981. 434p. NTIS, PC A19/MF A01.

This volume contains the findings of a three year study of the cetacea of the Southern California Bight (SCB) area. The distribution, abundance, movements, seasonality and reproductive status of cetacea of the SCB are discussed.

41465 **(PB—81-248197) Summary of marine mammal and seabird surveys of the Southern California Bight area, 1975-1978. Volume III - investigators' reports. Part III. Seabirds - book I. Chapter I - distribution, numbers, and seasonal status of seabirds of the Southern California Bight. Chapter II - beached bird surveys. Final report.** Briggs, K.T.; Chu, E.W.; Lewis, D.B.; Tyler, W.B.; Pitman, R.L. (California Univ., Santa Cruz (USA); Bureau of Land Management, Washington, DC (USA)). Apr 1981. 356p. NTIS, PC A16/MF A01.

This volume contains the findings of a three year study of the seabirds of the Southern California Bight area. The distribution, numbers and seasonal status, and results from beached birds surveys are discussed.

41466 **(PB—81-248205) Summary of marine mammal and seabird surveys of the Southern California Bight area, 1975-1978. Volume III - investigators' reports. Part III. Seabirds - book II. Reproductive ecology and foraging habits of breeding seabirds. Final report.** Hunt, G.L. Jr.; Pitman, R.L.; Naughton, M.; Winnett, K.; Newman, A. (California Univ., Santa Cruz (USA); Bureau of Land Management, Washington, DC (USA)). Apr 1981. 419p. NTIS, PC A18/MF A01.

This volume contains the findings of a three year study of the breeding seabirds of the Southern California Bight (SCB) area. The distribution, abundance, reproductive ecology, foods and foraging distribution of seabirds breeding in the SCB are discussed.

41467 **Movement patterns of coyotes in south central Washington.** Springer, J.T. (Washington State Univ., Pullman). *Journal of Wildlife Management;* **46**: No. 1, 191-200(1982). Contract EY-76-C-06-1830.

Ten coyotes (Canis latrans) fitted with radio transmitters on the U.S. Department of Energy Hanford Reservation in south central Washington were located daily over periods of 1-15 months. Because 82.9 of all locations were concentrated in only 6.9% of the total home range area, each home range was subdivided into an "impact area" and 1 or more "core areas." An "impact area" was defined as an area through which a coyote traveled and within which it might have interacted with other animals. "Core areas" were relatively small regions of concentrated use. No relationships were found between daily movements and relative and absolute changes in mean daily temperature and mean daily barometric pressure, or moon phases. The measured movement parameters of daily movement, core area size, and home range size, respectively, changed by seasons: fall, 3.1 km, 5.3 km^2, 98.6 km^2; winter, 4.7 km, 13.2 km^2, 143 km^2; spring, 2.6 km, 8.3 km^2, 58.2 km^2; summer, 3.3 km^2, 54.5 km^2; overall, 3.4 km, 7.9 km^2, 92.4 km^2. Home ranges measured were larger than averages reported in the literature. The coyotes studied were subject to levels of disturbance lower than those reported for other populations.

41468 **On some Cossuridae and Maldanidae (Polychaeta) from Washington and British Columbia.** Banse, K. (Univ. of Washington, Seattle). *Canadian Journal of Fisheries and Aquatic Science;* **38**: No. 6, 633-637(1981). Contract AT06-76EV75026.

Cossura soyeri Laubier and Clymenella torquata (Leidy) are newly recorded for the Pacific Ocean. Praxillella praetermissa (Malmgren) is new to the northeast Pacific. Another species of Cossura (unidentifiable) and Maldanella harai (Izuka) are added to the fauna of Washington and British Columbia.

5502 Biochemistry

REFER ALSO TO CITATION(S) 40341, 40349, 40367, 41188, 41206, 41207, 41209, 41491, 41494, 41496, 41497, 41498, 41499, 41500, 41507, 41532, 41533, 41534, 41538, 41539, 41549, 41550, 41552, 41625, 41635, 41644, 41665, 41695, 41703

41469 **(EUR—7567-EN) Working mechanism of hydrogenase.** Slater, E.C.; van Heerikhuizen, H. (B.C.P. Jansen Inst., Amsterdam (Netherlands). Lab. of Biochemistry). 1981. 45p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

A routine procedure for growth and harvesting of large (600 1) batches of Chromatium vinosum and the isolation scheme of the hydrogenase from 600 g of cells (wet weight) is described. The isolated enzyme is pure according to polyacrylamide-gel electrophoresis. The enzyme as isolated is inactive; in order to activate it, it has to be incubated in an oxyge-free atmosphere to release bound oxygen. Molecular weight determined by polyacrylamide-gel electrophoresis in the presence of SDS is 61,000 to 63,000. High-speed equilibrium sedimentation in the analytical ultracentrifuge yields a value of 62,000. These values are consistent with the elution behaviour on AcA44 columns. None of the inhibitors of hydrogenase activity has any effect on the shape or intensity of the EPR signal of the Fe-S cluster. Two electrons are removed from a hydrogen-reduced enzyme by oxidized cytochrome c. NADH in the presence of phenazine methosulfate (PMS), with a mid-point potential of about -320 mV or ascorbate in the presence of PMS, with a mid-point potential of about 0 mV, are capable of reducing the Fe-S cluster as judged by the disappearance of its EPR signal. Low concentrations of dimethylsulfoxide (DMSO) (< 40%) stimulate the hydrogenase activity while high concentrations (40 to 60%) inhibit; above 60% inhibition is complete. DMSO in concentrations up to 60%, however, does not have any influence on the EPR spectrum of the Fe-S cluster. It was concluded tht the Fe-S cluster in the hydrogenase of C. vinosum is not a part of the active site of the enzyme and that there probably exists another redox group with a rather low redox potential.

41470 **(EUR—7591-EN) Proprties of the retinal binding site in bacteriorhodopsin; use of retinol and retinyl moieties as fluorescent probes.** Oesterhelt, D.; Schreckenbach, T.; Walckhoff, B. (Wuerzburg Univ. (Germany, F.R.). Inst. fuer Biochemie). 1981. 27p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

Portions of document are illegible.

The fluorescence spectra of various reduced bacteriorhodopsin chromophore species indicate energy transfer from aromatic amino acid side chains of the protein to the retinyl moiety. Binding studies with retinol reveal that energy tranfer occurs only when the retinyl moiety is bound in the chromophoric site of the protein. By use of retro retinol as a fluorescent probe it is shown that fluorescence spectroscopy is a valuable tool for binding studies with retinol analogues.

41471 **Rapid inactivation of cathepsin L by Z-Phe-PheCHN$_2$ and Z-Phe-AlaCHN$_2$.** Kirschke, H. (Martin Luther Inst., Wittenberg, German Democratic Republic); Shaw, E. *Biochemical and Biophysical Research Communications;* **101**: No. 2, 454-458(30 Jul 1981).

Z-Phe-PheCHN$_2$ and Z-Phe-AlaCHN$_2$ were found to react extremely rapidly with cathepsin L from rat liver lysosomes. For measuring the inactivation time it was necessary to work with dilute enzyme and inhibitor solutions, that is in the range of 10^{-9} M. These conditions were made possible through the use of Z-Phe-Arg-4-methyl-7-coumarylamide, a very sensitive substrate suitable for assays of cathepsin L in about 10^{-12} M solutions. Z-Phe-AlaCHN$_2$ has an affinity for cathepsin L which is about 2000-fold higher than for cathepsin B from rat and human. Z-Phe-PheCHN$_2$ proved to be a selective inactivator of cathepsin L in a certain concentration range. Z-Phe-PheCHN$_2$ reacts reversibly with cathepsin B from several species.

41472 Interconversion of high density lipoproteins during incubation of human plasma. Nichols, A.V.; Gong, E.L.; Blanche, P.J. (Lawrence Berkeley Lab., CA). *Biochemical and Biophysical Research Communications;* **100**: No. 1, 391-399(15 May 1981).

Incubation (6h,37°) of untreated human plasma resulted in marked reductions in concentrations of two major subpopulations (mean sizes: ~84 angstroms and ~79 angstroms) of the HDL_3 subclass. These reductions were accompanied by the appearance of large species with mean particle size (95.2 angstroms) in the range of the HDL/sub 2a/ subpopulations. In the presence of mercaptoethanol (14 mM), incubation resulted in further reduction of the two HDL_3 subpopulations but now with formation of both larger (95.4 angstroms) and smaller (77.2 and 75.2 angstroms) species. Inhibitors of lecithin:cholesterol acyltransferase showed varying effectivenss in modifying the extent and character of the interconversion. With paraoxon (2 mM) the interconversion was much reduced and was associated with the formation predominantly of smaller particles (74.6 angstroms); with 5,5'-dithiobis-(2-nitrobenzoic acid) (1.4 mM) the interconversion resembled that produced with mecaptoethanol but to a considerably lesser degree. Incubation of HDL, ultracentrifugally isolated from nonincubated plasma containing paraoxon, resulted in negligible interconversion, suggesting that other plasma components participate in the process.

41473 Characterization and preliminary crystallographic data on the V/sub L/-related fragment of the human kI Bence Jones protein Wat. Stevens, F.J. (Argonne National Lab., IL); Westholm, F.A.; Panagiotopoulos, N.; Schiffer, M.; Popp, R.A.; Solomon, A. *Journal of Molecular Biology;* **147**: 185-193(1981). Contract W-31-109-ENG-38;W-7405-ENG-26.

A "naturally occurring" human kI V/sub L/ dimer, designated Wat, has been isolated and crystallized. Protein Wat consists of two non-covalently bound monomers, each having a molecular weight of ~11,500. The monomer subunit is composed of an entire variable region light chain (V/sub L/) domain closely homologous to that of the kI Bence Jones protein Roy (Hilschmann & Craig, 1965) as evidenced from amino acid composition, tryptic peptide map, and sequence analysis. Immunochemical studies substantiated that protein Wat is of the k Chain subgroup kI and lacks the isotypic and allotypic antigenic determinants associated with the k constant region light chain domain.Two types of crystals of V/sub L/ dimer Wat were obtained from ammonium sulfate or polyethylene glycol solutions. The type I crystals have unit cell dimensions of a=b=82.6 angstrom, c=60.3 angstrom, and the space group is hexagonal $P6_2$ or $P6_4$. The asymmetric unit consists of one V/sub L/ dimer; the fractional volume of unit cell occupied by solvent is 0.51. The unit cell dimensions of the type II crystals are a=b=108.3 angstrom, c=108.8 angstrom the space group is hexagonal $P6_122$ or $P6_522$. Three variable domains constitute the asymmetric unit of the type II crystals; the fractional value of the solvent (0.52) is compatible with the value obtained for the type I crystals.

41474 Preliminary crystallographic data on the human γIII Bence Jones protein dimer Cle. Stevens, F.J. (Argonne National Lab., IL); Westholm, F.A.; Panagiotopoulos, N.; Solomon, A.; Schiffer, M. *Journal of Molecular Biology;* **147**: 179-183(1981). Contract W-3H09-ENG-38.

A complete human γ Bence Jones protein dimer (Cle) has been isolated and crystallized. Protein Cle was characterized immunochemically and chemically as having a variable region amino acid sequence associated with light chains of the γ chain subgroup, γIII, and a constant region sequence characteristic of "non-Meg" type γ chains. Bence Jones protein Cle contains two covalently bound intact monomers, each having a molecular weight of ~23,000. Crystals of Bence Jones protein Cle, obtained from ammonium sulfate solutions, diffract to 2.6 angstrom resolution and have the orthorhombic space group $P2_12_12_1$ with cell dimensions a=113.0 angstrom b=72.3 angstrom and c=48.9 angstrom. The asymmetric unit consists of a dimer with a molecular weight of ~46,000.

41475 Nascent replicons are synchronously joined at the end of S phase or during G_2 phase in peas. Schvartzman, J.B.; Chenet, B.; Bjerknes, C.; Van't Hof, J. (Brookhaven National Lab., Upton, NY). *Biochimica et Biophysica Acta;* **653**: 185-192(1981).

In synchronized meristematic cells of Pisum sativum replicon-size DNA-fragments ((14-27) . 10^6 daltons) are not joined until the cells achieve a 4C DNA content. The combined use of a pulse-chase labeling protocol, single-cell autoradiography, cytophotometry, and velocity sedimentation in alkaline sucrose gradients showed that, unlike low molecular weight DNA (i.e., Okazaki fragments) which is ligated soon after replication starts, the joining of nascent replicon-size DNA is delayed until G_2. In addition, this observation argues for the existence of replicon termini, although the data are insufficient to determine the true nature of these termini, i.e., whether they are coded in the DNA itself or simply arise as a consequence of the convergence of two replicating forks.

41476 Effects of L-cysteine and O-acetyl-L-serine in the synthesis and mutagenicity of azide metabolite. Owais, W.M.; Kleinhofs, A.; Nilan, R.A. (Washington State Univ., Pullman). *Mutation Research;* **80**: 99-104(1981). Contract EY-76-S-06-2221.

The ability of L-cysteine to inhibit azide-metabolite synthesis and mutagenicity is investigated in Salmonella typhimurium TA1530 and cys E_6 strains. L-cysteine specifically inhibits the synthesis of the mutagenic azide metabolite as other compounds containing SH group did not affect the production of this metabolite. Azide mutagenicity is completely inhibited by L-cysteine at a concentration (5 μmoles/plate) where the metabolite mutagenicity was not affected. O-Acetyl-L-serine can reverse the L-cysteine mediated inhibition of the metabolite synthesis and thus mutagenicity in the same strains. These results suggest that O-acetyl-L-serine may be required to synthesize the azide metabolite or its precursor.

41477 The adsorption of divalent cations to phosphatidylglycerol bilayer membranes. Lau, A. (Brookhaven National Lab., Upton, NY); McLaughlin, A.; McLaughlin, S. *Biochimica et Biophysica Acta;* **645**: 279-292(1981).

The ability of the Stern equation to describe the adsorption of divalent cations to phosphatidylglycerol membranes was tested by combining ^{31}P-NMR and electrophoretic mobility measurements. In 0.1 M sodium chloride both the ^{31}P-NMR and the zeta potential data are well described by the Stern equation. ^{31}P-NMR and ^{13}C-NMR results indicate that cobalt forms inner-sphere complexes only with the phosphate group of phosphatidylglycerol molecules and that a substantial fraction of the adsorbed cobalt ions form outer-sphere complexes. Evidence is presented that suggests the alkaline earth cations also bind to phospholipids mainly by forming outer sphere complexes. Electrophoretic mobility measurements were performed with several different divalent cations. In all cases the zeta potentials in 0.1 M sodium chloride were well described by the Stern equation. The intrinsic 1 : 1 association constants (M^{-1}) for the phosphatidylglycerol complexes decreased in the sequence: Mn^{2+}, 11.5; Ca^{2+}, 8.5; Ni^{2+}, 7.5; Co^{2+}, 6.5; Mg^{2+}, 6.0; Ba^{2+}, 5.5 and Sr^{2+}, 5.0.

41478 Biochemical factors affecting the quantum efficiency of hydrogen production by membranes of green photosynthetic bacteria. Bernstein, J.D.; Olson, J.M. (Brookhaven National Lab., Upton, NY). *Photochemistry and Photobiology;* **34**: 725-731(1981).

Photohydrogen production, 200-700 μmol H_2 h^{-1} (mg bacteriochlorophyll a)$^{-1}$ has been obtained in a system containing unit membrane vesicles (Complex I) from the green photosynthetic bacterium Chlorobium limicola f. thiosulfatophilum, ascorbate, N,N,N',N'-tetramethyl-p-phenylenediamine, dithioerythritol, an oxygen scavenging mixture, either methyl viologen (MV) or clostridial ferredoxin (CPS Fd) as electron carrier, and either CPS hydrogenase or platinum asbestos as catalyst. All components are necessary for maximum activity, and spinach Fd cannot be substituted for CPS Fd. Higher rates of photohydrogen production are obtained using MV or CPS Fd with hydrogenase than with MV and Pt asbestos. The highest quantum efficiencies (7-10% at 0.2-0.9 mW absorbed light and over 20% at lower light) were obtained with

CPS Fd, hydrogenase and non-saturating 812 nm light. With saturating white light, however, rates of photohydrogen production varied relatively little among the various combinations of electron carrier and catalyst tested. The reaction rate is unaffected by 0.03% Triton X-100, and is insensitive to treatment with antimycin a or m-chloro-carbonyl cyanide phenylhydrazone.This indicates that neither electron flow through an endogenous cyclic chain, nor maintenance of a proton gradient are involved in this process.

41479 **Mutagenesis and transformation of C3H 10T 1/2 cells treated with ethyl methanesulfonate.** Evans, H.H.; Wilkins, L.; Horng, M.F.; Santoro, C.; Evans, T.E.; Glazier, K.G. (Case Western Reserve Univ., Cleveland, OH). *Mutation Research;* **84**: 203-219(1981). Contract AC02-77EV04472.

Survival, mutagenesis and transformation were measured in mouse embryo C3H 10T 1/2 cells following treatment with ethyl methanesulfonate (EMS). Ouabain-resistant cells and transformed cells were isolated, and reconstruction experiments were carried out to determine the optimum conditions for the measurement of mutation and transformation frequencies. Survival was measured by plating efficiency; mutagenesis was measured in terms of the induction of cells able to form colonies in the presence of ouabain; and transformation was measured by the induction of cells forming either morphologically altered colonies on a monolayer of contact-inhibited cells or of cells capable of forming colonies in semi-solid media. When confluent monolayers were incubated for 4 h after treatment with EMS, to allow excision repair before the resumption of DNA synthesis, survival as well as the frequencies of both mutation and transformation increased. When this repair (or holding) period was extended to 24 h, the frequencies of mutation and transformation both decreased as compared to the 4-h holding period. Thus, the holding periods affect the frequencies of EMS-induced mutagenesis and transformation similarly.

41480 **Cell cycle kinetics of chinese hamster (CHO) cells treated with the iron-chelating agent picolinic acid.** Gurley, L.R.; Jett, J.H. (Los Alamos Scientific Lab., NM). *Cell and Tissue Kinetics;* **14**: 269-283(1981).

Spontaneoulsy transformed (tumorigenic) Chinese hamster cells (line CHO) do not exhibit picolinic acid-sensitive G_1 and G_2 cell cycle arrest points observed in normal and virus-transformed cells. Rather, picolinic acid arrests CHO cells in S phase only and produces culture growth behaviour similar to that produced by hydroxyurea. Prolonged treatment with picolinic acid permits a slow but significant traverse of cells through S phase. Thus, like hydroxyurea, picolinic acid is not a useful agent for synchronizing exponential CHO cells, but it can be used to resynchronize cultures in early S phase if a previous synchronization procedure (such as isoleucine deprivation) is used. The iron chelating properties of picolinic acid, and the similarities of its effects on cultured cells to those of hydroxyurea and the iron-chelating drug desferrioxamine, suggest that picolinic acid inhibits DNA synthesis by interfering with the iron-dependent production of a stable free organic radical which is essential for the ribonucleotide reductase formation of deoxyribonucleotides.

41481 **Study of conformational states and reversibility of histone complexes.** Beaudette, N.V.; Fulmer, A.W.; Okabayashi, H.; Fasman, G.D. (Brandeis Univ., Waltham, MA). *Biochemistry;* **20**: 6526-6535(1981). Contract EP-78-S-02-4962.A 000.

The core histone complex $(H3:H4:H2A:H2B)_2$ and products of dissociation, the H2A:H2B dimer and the H3:H4 tetramer, were isolated from chicken erythrocyte chromatin by several literature methods as well as gel filtration on Bio-Gel A15m at various salt concentrations. The conformational and oligomeric charactristics of these histone complexes were compared to analogous histone complexes prepared by renaturation of individually acid-extracted histones by circular dichroism (CD) and analytical gel filtration chromatography. The salt-extracted core histone complex (independent of method of preparation), the purified dissociation products, the H2A:H2B dimer, and the H3:H4 tetramer in 2 M NaCl, 10 mM sodium phosphate, 0.25 mM EDTA, and 0.1 mM DTT, pH 7.0, have conformations which are identical, by the criteria of similar CD spectra, with complexes prepared from acid-extracted histones. Likewise, the salt-extracted complexes may be cycled through solvents of low ionic strength (10 mM sodium phosphate, pH 7.0, or 50 mM NaOAc, pH 5.0) or 1 mM HCl and returned to 2.0 M NaCl, 10 mM sodium phosphate, 0.25 mM EDTA, and 0.1 mM DTT, pH 7.0, in a completely reversible manner. Thus it would appear that acid-denatured histones are capable of being fully renatured to yield native-like complexes.

41482 **Sequential folding of a messenger RNA molecule.** Nussinov, R.; Tinoco, I. Jr. (Univ. of California, Berkeley). *Journal of Molecular Biology;* **151**: 519-533(1981). Contract W-7405-ENG-48.

The existence of a new, efficient algorithm for secondary structure prediction enables us to study the folding pattern of a messenger RNA chain. Our results indicate that successively longer RNA sequences with the same 5'-ends fold sequentially, usually keeping the stable close-range hairpin loops and rearranging the long-range stems. This path will shorten the time the messenger RNA molecule needs in order to attain its preferred structure. It can also align splicing sites in a favorable orientation before the whole molecule is synthesized. Our studies wer carried out on the simian virus 40 late precursor and processed mRNA.

41483 **Glycosylation of apolipoproteins by cultured rat hepatocytes: effect of tunicamycin on lipoprotein secretion.** Bell-Quint, J.; Forte, T.; Graham, P. (Lawrence Berkeley Lab., CA). *Biochemical Journal;* **200**: 490-414(1981).

Cultured rat hepatocytes were used to measure hepatic synthesis of rat plasma glycoproteins. [/sup 3/H]Glucosamine was progressively incorporated into the protein of hepatocyte culture media very-low-density lipoprotein, low-density lipoprotein, high-density lipoprotein and the $p > 1.21$ g/ml fraction after 3.5 and 6.5h incubation. Apolipoproteins B, E and C, as well as transferrin, were identified as glycoproteins. The association of radioactivity with apolipoprotein C of hepatocyte very-low-density and high-density lipoproteins suggests that apolipoprotein C-III-3, the only C apoglycoprotein in the rat, is synthesized de nove by the hepatocytes. Treatment of hepatocytes with tunicamycin, a specific inhibitor of protein glycosylation, resulted in a substantial decrease in [/sup 3/H]glucosamine incorporation into hepatocyte very-low-density, low-density and high-density lipoproteins and $p > 1.21$ g/ml protein, but had little or no effect on secretion. In the rat, hepatic secretion of lipoproteins and transferrin does not appear to be dependent on prior glycosylation.

41484 **Simplified method for DNA and protein staining of human hematopoietic cell samples.** Crissman, H.A. (Los Alamos National Lab., NM); Egmond, J.V.; Holdrinet, R.S.; Pennings, A.; Haanen, C. *Cytometry (Baltimore);* **2**: No. 2, 59-62(1981).

A rapid reproducible method yielding high resolution analysis of DNA and protein in human hematopoietic cell samples has been developed by modification of the propidium iodide and fluorescein isothiocyanate procedure. Cell staining involves sequential addition of each reagent (RNase, fluorescein isothiocyanate and propidium iodide) to ethanol-fixed cells and requires no centrifugation steps. Stained cells are analyzed in the reagent solutions. Analysis of bone marrow samples from multiple myeloma patients showed mixed normal and aneuploid populations with a major portion of the aneuploid cells having a significantly higher protein content. This approach permitted differential cell cycle analysis of normal and the aneuploid populations.

41485 **Cleavage sites in the polypeptide precursors of poliovirus protein P2-X.** Selmer, B.L. (State Univ. of New York, Stony Brook); Hanecak, R.; Anderson, C.W.; Wimmer, E. *Virology;* **114**: 589-594(1981).

Partial amino-terminal sequence analysis has been performed on the three major polypeptide products (P2-3b, P2-5b, and P2-X) from the central region (P2) of the poliovirus polyprotein, and this analysis precisely locates the amino termini of these products with respect to the nucleotide sequence of the poliovirus RNA genome. Like most of the products of the replicase region (P3), the amino termini of P2-5b and P2-X are generated by cleavage between glutamine and glycine residues. Thus, P2-5b and P2-X are probably

both produced by the action of a singly (virus-encoded?) proteinase. The amino terminus of P2-3b, on the other hand, is produced by a cleavage between the carboxy-terminal tyrosine of VP1 and the glycine encoded by nucleotides 3381-3383. This result may suggest that more than one proteolytic activity is required for the complete processing of the poliovirus polyprotein.

41486 **Histone acetylation and heterochromatin content of cultured Peromyscus cells.** Halleck, M.S.; Carley, L.R. (Los Alamos National Lab., NM). *Experimental Cell Research;* **132**: 201-213(1981).

In order to explore the relationship between unacetylated arginine-rich histones and condensed chromatin structure, the extent of histone acetylation was examined in cultured cell lines derived from three species of deer mice. These species differ considerably in their genomic content of heterochromatin but contain essentially the same euchromatin content. Cells of Peromyscus eremicus, containing 34-36% more constitutive heterochromatin than Peromyscus boylii or Peromyscus crinitus cells were found to contain 28-35% more unacetylated histone H4, 22-29% more unacetylated histone H3, and 18-22% more unacetylated histone H2B. This relationship between unacetylated histone and heterochromatin content was further explored by inducing hyperacetylation of P. eremicus and P. boylli histones through treatment of cells with 15 mM sodium butyrate for 24 h. It was found that the percentages of unacetylated histones H3 and H4 remaining after butyrate treatment were proportional to the amount of constitutive heterochromatin in the genome. These data support the concept that a small core of histones in constitutive heterochromatin is inaccessible to acetylation. It was also found that the acetylated state of isolated histones was senstitive to the method of histone extraction. Thus concern must be given to preparative procedures when studying histone acetylation in order to minimize these acetate losses.

5503 Cytology

REFER ALSO TO CITATION(S) 41484, 41543, 41590, 41607, 41635, 41661

41487 (LMF—91, pp 479-483) **Development and characterization of a type II lung epithelial cell line for cell toxicology testing of airborne pollutants.** Li, A.P.; Zamora, P.O.; Hahn, F.F.; Henderson, R.F.; Brooks, A.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

A lung epithelial cell line (LEC) was derived from the lungs of an adult male Fischer-344 rat and maintained in vitro for over 9 months. Their epithelial morphology and the presence of intracellular lamellar inclusions suggested that they were of type II alveolar cell origin. The cells were diploid at low passages and had an extra number one chromosome at passage 18. Synthesis and secretion of disaturated lecithins, a major component of pulmonary surfactants, were demonstrated in these cells. The ability of these cells to metabolize promutagens benzo(a)pyrene, dimethylnitrosamine and 3-methylcholanthrene was tested through co-cultivation of the LEC cells with CHO cells. The LEC cells were cultured on collagen gels at an air/water interface, providing a system to expose lung cells directly to airborne toxicants. Exposure to NO_2 resulted in cytotoxicity, decreases in ^{3}H-lysine incorporation and morphological alterations similar to those found in vivo.

41488 **The kinetics of ionophore X-537A-mediated transport of manganese through dipalmitoylphosphatidylcholine vesicles.** Degani, H. (Weizman Inst. of Science, Rehovot, Israel); Simon, S.; McLaughlin, A.C. *Biochimica et Biophysica Acta;* **646**: 320-328(1981).

We have studied the kinetics of ionophore X-537A-mediated transport of manganese ions into small unilamellar vesicles formed from dipalmitoylphosphatidylcholine. To follow the transport we used the paramagnetic effect of manganese on the ^{1}H-NMR signal from choline trimethylammonium groups on the inner phospholipid monolayer. The transport of only one manganese ion produces an intravesicular concentration which is high enough (approx. 1mM) to substantially broaden this signal. The observed signal thus arises predominantly from those vesicles which contain no manganese. Therefore, as manganese is transported into the vesicles the observed signal decreases in intensity, but does not broaden. The initial time-dependence of the intensity of the signal, S(t), can be approximated by the simple first-order rate law: $S(t)=S(O)\exp(-k't)$, where k' is the probability per unit time for the transport of a manganese ion from the external medium to the intravesicular space. From the dependence of k' on the ionophore X-537A concentration we conclude that manganese is transported into the vesicles via both 1 : 1 and 2 : 1 complexes with ionophore X-537A. At low ratios of ionophore X-537A to vesicles transport via the 1 : 1 complex predominates; at high ratios transport via the 2 : 1 complex predominates. From the dependence of k' on manganese concentration we determined that under our conditions the equilibration of ionophore X-537A between vesicles is much faster than the transport of manganese through the vesicles. Lastly, from the dependence of k' on temperature, we conclude that the ionophore X-537A-mediated transport of manganese into the dipalmitoylphosphatidylcholine vesicles is very sensitive to the gel-liquid crystalline phase transition.

41489 **Comparison of two methods for detecting translocation heterozygotes in mice.** Generoso, W.M. (Oak Ridge National Lab., TN); Krishna, M.; Cain, K.T.; Sheu, C.W. *Mutation Research;* **81**: 177-186(1981). Contract W-7405-ENG-26.

An accurate estimate of the error of misclassifying male translocation heterozygotes as normals is essential for the proper evaluation of results of the heritable translocation test in mice. The size of this error may vary from one laboratory to another depending, primarily, on the method or variation of the method used in screening for translocation heterozygotes. This report shows a way to estimate the misclassification errors involved in two methods, sequential and direct cytological analysis, of screening for translocation heterozygotes. A positive correlation was found between the degree of partial sterility of a male and the frequency of cells with multivalent configurations among his diakinesis-metaphase I cells. We interpreted this to confirm that the length of translocated chromosome segments has some influence on the proportion of unbalanced gametes in the ejaculate, presumably reflecting the frequency with which adjacent-1 and adjacent-2 segregations and 3-1 misdivisions occur.

41490 **An improved sum-of-normals technique for cell cycle distribution analysis of flow cytometric DNA histograms.** Jett, J.H.; Gurley, L.R. (Los Alamos Scientific Lab., NM). *Cell and Tissue Kinetics;* **14**: 413-423(1981).

An improved method for determining the fraction of cells in the G/sub 1/,S and G/sub 2/ + M phases of the life cycle, from DNA distributions of S phase rich cultures, is presented. Picolinic acid synchronized cell cultures were used to demonstrate the usefulness of the technique for the cell cycle distribution analysis. The algorithm presented quantifies DNA histograms from FCM analyses using an extension of the previously report 'sum of discrete normal curves' technique. It alleviates problems encountered with earlier methods by extending the contribution of the S phase cells to the distribution under the G/sub 1/ and G/sub 2/ + M peaks; at the same time it allows more of the descriptive parameters to be determined from the individual histograms. The fractions of cells in the G/sub 1/, S, and G/sub 2/ + M phases of the life cycle obtained by this method compare favourably with autoradiographic analyses and other analytical results.

41491 **Enzymic and protein character of tonoplast from Hippeastrum vacuoles.** Wagner, G.J. (Brookhaven National Lab., Upton, NY). *Plant Physiology;* **68**: 499-503(1981).

The membrane of anthocyanin containing Hippeastrum petal vacuoles was examined for protein and enzyme content after purification by equilibrium density centrifugation. Light scattering, protein, and a Mg^{2+} -dependent nucleotide specific ATPase were associated with membrane having a density of 1.08 to 1.12 grams per cubic centimeter. A small amount of acid phosphatase was also present in this region of the gradient, but this activity peaked at about 1.12 grams per cubic centimeter. A component of yeast tonoplast, α-mannosidase, was not significantly present. UDP-glucose, anthocyanidin-3-O-glucosyltransferase, thought to be a cytosol enzyme in Hippeastrum, was absent from tonoplast of vacuoles iso-

lated by osmotic shock in 0.2 molar K_2HPO_4 or 0.35 molar mannitol. Vacuolar acid phosphatase was insensitive to ethylenediaminetetraacetate but was 80% inhibited by 10 millimolar KF, while ATPase was inactivated by 2 millimolar ethylenediaminetetraacetate and only 50% inhibited by 10 millimolar KF,. Five major and about 9 minor polypeptides were detected by sodium dodecyl sulfate-polyacrylamide gel electrophoresis of membrane protein on 5 to 30 and 6 to 16% gradient gels.

41492 Analysis of coated pit recycling on human fibroblasts. Goldstein, B. (Los Alamos Scientific Lab., NM); Wofsy, C. *Cell Biophysics;* 3: 251-277(1981).

The recycling to the cell surface of previously internalized coated pits has been proposed as a likely mechanism for the rapid regeneration of coated pits on human fibroblast surfaces at 37°C. We present a general mathematical model of coated pit recycling for the case when the coat cycles as a single unit, and use it to analyze certain time and temperature dependent data obtained by Anderson et al. and Vermeer et al. We show how recycling can account for these data and how this type of data can be used to distinguish between different possible recycling mechanisms. We show that these data are inconsistent with a two compartment model where coat material simply shuttles back and forth between coated pits and short-lived coated vesicles. From these data we estimate for human fibroblasts at 37°C: that the time for a coated pit to be replenished through recycling after it is lost through internalization is greater than 3.5 min; and that at any moment 53% or less of the cell's clathrin that is involved in coated pit recycling is on the cell surface.

41493 Metabolic cooperativity between epithelial cells and adipocytes of mice. Bartley, J.C.; Emerman, J.T.; Bissell, M.J. (Lawrence Berkeley Lab., CA). *American Journal of Physiology;* 241: C204-C208(1981). Contract W-7405-ENG-48.

We have demonstrated that glycogen and lipid synthesis in adipocytes is modulated by the lactational state and that this modulation in mammary adipocytes requires the presence of the adjacent epithelial cells. Glycogen and lipid synthesis from [^{14}C]glucose was measured in mammary fat pads cleared of epithelium, in abdominal fat pads, and in adipocytes from both sources and from intact mammary gland of mature virgin, pregnant, and lactating mice. Accumulation of glycogen, the activity of glycogen synthase, and the lipogenic rate in abdominal and mammary adipocytes remained high during pregnancy but decreased to insignificant levels by early lactation. The depressant effects of lactation were observed solely in those mammary adipocytes isolated from intact glands. The presence of mammary epithelial cells was also required to effect the stimulated lipogenesis in mammary adipocytes during pregnancy. We conclude that the metabolic activity of adipocytes is modulated both during pregnancy and lactation to channel nutrients to the mammary epithelial cell. The fact that the changes occur in mammary adipocytes only when epithelial cells are present indicates that local as well as systemic factors are operating in these modulations.

5504 Genetics

REFER ALSO TO CITATION(S) 41476, 41486, 41489, 41534, 41536, 41558, 41601, 41625, 41662, 41687, 41688, 41689, 41691, 41692, 41693, 41698, 41712

41494 (DOE/EV/03083—T2) Nucleic acids and protein-synthesizing mechanisms in mitochondria. Suyama, Y. (Pennsylvania Univ., Philadelphia (USA). Dept. of Biology). 1 Jan 1982. Contract AS02-76EV03083. 6p. NTIS, PC A02/MF A01. Order Number DE82008851.

Out of 29 restriction enzymes used, 24 were found to restrict the linear mitochondrial DNA of Tetrahymena pyriformis strain ST, and 15 were found suitable for constructing fine restriction maps. Mitochondrial ribosomal RNAs and EcoR1 fragments were also used as hybridization probes to further define the locations of restriction fragments and also to detect heterogeneous terminal restriction fragments. The sum of the lengths of restriction fragments varies depending on the restriction enzymes used. The largest was 51,000 +- 1000 base pairs obtained with Hinc II, and the lowest 42,630 base pairs with Hind III. The restriction sites were uniformly distributed throughout the genome length, and no clear hot spots were apparent. The yeast mitochondrial DNA probes containing the specific gene sequences ATPase VI and IX, Oxi-I, and Cob, 21S and 15S rRNAs, and mouse mitochondrial DNA exhibited no significant specific sequence homologies to Tetrahymena mtDNA restriction fragments. However, a 127 base sequence of the 14S rRNA cistron segment revealed sequence homologies of 9 and 11 bases to the corresponding portion of the 12S rRNA gene of human mtDNA.

41495 The cycl-11 mutation in yeast reverts by recombination with a nonallelic gene: composite genes determining the iso-cytochromes c. Ernst, J.F. (Univ. of Rochester, NY); Stewart, J.W.; Sherman, F. *Proceedings of the National Academy of Sciences of the United States of America;* 78: No. 10, 6334-6338(Oct 1981). Contract AC02-76EV03490.

DNA sequence analysis of a cloned fragment directly established that the cycl-11 mutation of iso-l-cytochrome c in the yeast Saccharomyces cerevisiae is a two-base-pair substitution that changes the CCA proline codon at amino acid position 76 to a UAA nonsense codon. Analysis of 11 revertant proteins and one cloned revertant gene showed that reversion of the cycl-11 mutation can occur in three ways: a single base-pair substitution, which produces a serine replacement at position 76; recombination with the nonallelic CYC7 gene of iso-2-cytochrome c, which causes replacement of a segment in the cycl-11 gene by the corresponding segment of the CYC7 gene; and either a two-base-pair substitution or recombination with the CYC7 gene, which causes the formation of the normal iso-l-cytochrome c sequence. These results demonstrate the occurrence of low frequencies of recombination between nonallelic genes having extensive but not complete homology. The formation of composite genes that share sequences from nonallelic genes may be an evolutionary mechanism for producing protein diversities and for maintaining identical sequences at different loci.

41496 Altered ribosomal protein S11 from the SUP46 suppressor of yeast. Ishiguro, J. (Konan Univ., Okamoto, Japan); Ono, B.I.; Masurekar, M.; McLaughlin, C.S.; Sherman, F. *Journal of Molecular Biology;* 147: 391-397(1981). Contract AC02-76EV03490.

The dominant suppressor SUP46 of the yeast Saccharomyces cerevisiae was shown to act on a wide range of mutations (preceding paper by Ono et al., 1981). Masurekar et al. (1981) demonstrated that ribosomes from the SUP46 strain make an abnormally high rate of errors in a cell-free translation system. These findings indicated that SUP46 suppression was the result of abnormal ribosomes misreading mutant codons. We have used two-dimensional polyacrylamide gel electrophoresis to show that the S11 protein from the 40 S ribosomal subunit has an altered electrophoretic mobility. Thus the gene product of the SUP46 locus is either the S11 ribosomal protein or an enzyme that modifies the S11 protein. These results demonstrate that the altered S11 protein is responsible for the suppression by misreading.

41497 Misreading of the ribosomal suppressor SUP46 due to an altered 40 S subunit in yeast. Masurekar, M. (Univ. of Rochester, NY); Palmer, E.; Ono, B.I.; Wilhelm, J.M.; Sherman, F. *Journal of Molecular Biology;* 147: 381-390(1981). Contract AC02-76EV3490.

The dominant suppressor, SUP46, in the yeast Saccharomyces cerevisiae acts on a wide range of different types of mutations. The incorporation of phenylalanine and the misincorporation of leucine in a cell-free system programmed with poly(U) indicated that the ribosomes from a SUP46 strain produce abnormally high rates of translation errors. Furthermore, the cell-free translation system was used to demonstrate that the SUP46 defect resides in the 40 S ribosomal subunit. The growth of SUP46 strains was shown to be unusually sensitive to paromomycin, an aminoglycoside antibiotic that is known to induce translation errors. In addition, paromomycin stimulated mistranslation with SUP46 ribosomes to a greater extent than with normal ribosomes. These results indicate that SUP46 suppression is caused by increased translation errors as a result of the mutationally altered 40 S ribosomal subunit. Paromomycin appears to produce translation errors in SUP46 strains at rates that are too high for cellular growth.

41498 **Serine insertion caused by the ribosomal suppressor SUP46 in yeast.** Ono, B.I. (Okayama Univ., Japan); Stewart, J.W.; Sherman, F. *Journal of Molecular Biology;* **147**: 373-379(1981). Contract AC02-76EV03490.

The ribosomal suppressor SUP46 isolated from the yeast Saccharomyces cerevisiae suppresses a broad range of mutations, including at least some UAA, UAG and UGA alleles. The SUP46 suppressor causes the insertion of serine into iso-l-cytochrome c at the site of the UAA mutation in the cycl-72 allele. It is believed that the altered ribosomes in the SUP46 suppressor allow a serine tRNA to misread UAA codons.

41499 **Correspondence of yeast UAA suppressors to cloned tRNA/subUCA//sup Ser/ genes.** Broach, J.R. (State Univ. of New York, Stony Brook); Friedman, L.; Sherman, F. *Journal of Molecular Biology;* **150**: 375-387(1981). Contract AC02-76EV03490.

The genes encoding tRNA/sub UCA//sup Ser/ of yeast were analyzed. By hybridization analysis it was established that only three genes encode tRNA/sub UCA//sup Ser/, all of which have been cloned. The DNA sequences of the coding regions of all the three genes are identical, although considerable sequence divergence exists at the 3′ and5′ flanking regions. The suppressor locus to which each of the three cloned tRNA/sub UCA//sup Ser/ genes corresponds was determined by integrative transformation of yeast. A $leu2^-$ sup^+ yeast strain was transformed to Leu^+ with plasmids which carried the LEU2 gene of yeast and one of the DNA fragments containing a tRNA/sub UCA//sup Ser/ gene. Integration of the plasmid at the homologous transfer RNA locus on the chromosome introduced the LEU2 marker at the site, which could then be followed in standard genetic crosses. By this method, we have shown that the three cloned fragments correspond to the serine-inserting nonsense suppressors SUP16, SUP17 and SUP19. Finally, the SUP16 allele was recovered directly from yeast by integrating a pBR322-LEU2-$sup16^+$ hybrid plasmid at the SUP16 locus. Appropriate digestion of genomic DNA isolated from the transformed strain permitted recovery of either the wild-type allele or the SUP16 allele on plasmids that were otherwise identical to the original transforming plasmid. This method is generally applicable to the recovery of any mutant allele of yeast for which one has DNA containing the corresponding wild-type gene.

41500 **Transposition of the gene cluster CYC1-OSM1-RAD7 in yeast.** Stiles, J.I.; Friedman, L.R.; Helms, C.; Consaul, S.; Sherman, F. (Univ. of Rochester, NY). *Journal of Molecular Biology;* **148**: 331-346(1981). Contract AC02-76EV03490.

A mutant of the yeast Saccharomyces cerevisiae contains an increased amount of iso-l-cytochrome c because two copies of a segment, denoted COR, were transposed to a new position on chromosome VII, while the original COR region was retained at the normal position on chromosome X; this COR segment encompasses the CYC1, OSM1 and RAD7 loci which determine, respectively, iso-l-cytochrome c, osmotic sensitivity and ultraviolet light sensitivity. The analysis of genomic DNA with cloned probes indicates that the length of the COR segment is approximately 12,000 basepairs. We suggest that certain normal strains of yeast, which possibly may contain reiterated sequences, can produce extended transpositions similar to prokaryotes.

41501 **Fluctuation analyses of spontaneous mutations to 6-thioguanine resistance in Chinese hamster ovary cells in culture.** O'Neill, J.P.; Brimer, P.A.; Hsie, A.W. (Oak Ridge National Lab., TN). *Mutation Research;* **82**: 343-353(1981). Contract W-7405-ENG-26.

Fluctuation analyses of the spontaneous appearance of 6-thioguanine (TG)-resistant mutants in cultured Chinese hamster ovary (CHO) cells were performed to investigate (1) whether the resistance is induced by the selective agent or is the result of a mutation which occurs prior to the TG selection and (2) to estimate the spontaneous mutation rate at the hypoxanthine-guanine phosphoribosyl transferase (hgprt) locus. The potential problem of phenotypic delay was minimized by allowing an adequate expression time through maintenance of the cultures in a division-arrested, viable state. The results demonstrate that the TG-resistant (TG/sup r/) cells arise randomly in the cultures, independently of the selective agent, which is consistent with spontaneous mutations. The average values for mutation rate +/- standard deviation, based on 4 independent determinations and 2 methods of calculation, are 3.4 +/- 1.2 x 10^{-7} (median method) and 5.1 +/- 1.8 x 10^{-7} (mean method) mutants/cell/generation.

41502 **Diethylstilbestrol-diphosphate induces chromosomal aberrations but not sister chromatid exchanges in murine bone marrow cells in vivo.** Ivett, J.L. (North Carolina State Univ., Raleigh); Tice, R.R. *Environmental Mutagenesis;* **3**: 445-452(1981). Contract AC02-76CH00016.

Diethylstilbestrol diphosphate (DES-dp) clastogenesis was examined in the bone marrow of C57B1/6 male and female mice. Significant and sex-related dose effects were observed for the induction of chromatid-type chromosomal aberrations and for the inhibition of cellular proliferation. Females were more sensitive to the effects of DES-dp than males when assessed for either induced chromosomal aberrations or proliferative inhibition. Contrary to other published results, we did not observe either an increase in sister chromatid exchanges or an increased incidence of aneuploidy. Ovariectomy reduced the ability of DES-dp to inhibit cellular proliferation and decreased the high degree of variability between animals at high doses of DES-dp. The results of our studies show that DES is a clastogenic agent in vivo which may relate to its carcinogenicity.

41503 **Mutagenicity and cytotoxicity of haloethanes as studied in the CHO/HGPRT system.** Tan, E.L. (Univ. of Tennessee, Oak Ridge); Hsie, A.W. *Mutation Research;* **90**: 183-191(1981). Contract W-7405-ENG-26.

When haloethanes were being tested as direct-acting agents in the Chinese hamster ovary cell/hypoxanthine-guanine phosphoribosyl transferase (CHO/HGPRT) system, ethylene dibromide ($EtBr_2$) exhibited more cytotoxic and mutagenic activity than ethylene dichloride ($EtCl_2$), and the mixed halogenated congener ethylene bromochloride (EtBrCl) had an intermediate effect. On a molar basis, the relative mutagenic activity of $EtBr_2$: EtBrCl : $EtCl_2$ was approximately 100 : 6 : 1. Cell survival was reduced to 50% by approx. 3, 6 and 50 mM of $EtBr_2$, EtBrCl and $EtCl_2$, respectively, and declined precipitously with increasing concentrations of the haloethanes. When these 3 haloethanes were assayed in the presence of S9, there was a 5-25-fold increase in cytotoxicity; however, only EtBrCl and $EtCl_2$ also showed a concomitant increase in mutagenicity of 4-fold. The mutagenicity of $EtBr_2$ remained unchanged when assayed in the presence of S9. When NADP was omitted from the S9 mix, which contains a NADPH-regenerating system, the increase in cytotoxicity and mutagenicity observed with complete S9 mix was abolished. $EtBr_2$ was shown to possess a molar equivalent mutagenic activity to ethyl methanesulfonate under the conditions of the assay. The cytotoxicity of $EtBr_2$ increased as the time of treatment increased up to 24 h, while mutation induction appeared to peak at around 5 h.

41504 **Ontogeny of the barley plant as related to mutation expression and detection of pollen mutations.** Hodgdon, A.L.; Marcus, A.H.; Arenaz, P.; Rosichan, J.L.; Bogyo, T.P.; Nilan, R.A. (Washington State Univ., Pullman). *Environmental Health Perspectives;* **37**: 5-7(1981). Contract AM06-76RLO2221.

Clustering of mutant pollen grains in a population of normal pollen due to premeiotic mutational events complicates translating mutation frequencies into rates. Embryo ontogeny in barley will be described and used to illustrate the formation of such mutant clusters. The nature of the statistics for mutation frequency will be described from a study of the reversion frequencies of various waxy mutants in barley. Computer analysis by a "jackknife" method of the reversion of a waxy mutant treated with the mutagen sodium azide showed a significantly higher reversion frequency than untreated material. Problems of the computer analysis suggest a better experimental design for pollen mutation experiments. Preliminary work on computer modeling for pollen development and mutation will be described.

5505 Metabolism

REFER ALSO TO CITATION(S) 41493, 41556

41505 Energy transfer in a light-harvesting carotenoid-chlorophyll c-chlorophyll a-protein of Phaeodactylum tricornutum. Gugliemelli, L.A. (U.S. Dept. of Agriculture, Peoria, IL); Dutton, H.J.; Jursinic, P.A.; Siegelman, H.W. *Photochemistry and Photobiology;* **33**: 903-907([nd]).

The marine diatom Phaeodactylum tricornutum was readily disrupted in 0.1 N Tris-HCl buffer, pH 7.8 in a Braun Model MSK cell homogenizer at 0-5°C. Treatment of the suspension with sodium lauryol sarcosinate (3 molecules per 10000 daltons of protein) at 5°C in the dark and subsequent centrifugations produced a pigmented, protein fraction whose excitation spectrum exhibited energy transfer from carotenoids to chlorophyll a (Chl a). Disruption of the pigment-protein complex by heating in 1% sodium dodecylsulfate resulted in loss of energy transfer. For each Chl a molecule this fraction had 1 Chl c, 4 fucoxanthin, and 6.7 accessory pigment molecules. Presence of the accessory complex of Photosystem II in this preparation is suggested by the high xanthophyll content. Further, based on Chl a concentrations, this fraction had about 18 times more apparent fluorescence emission at 680 nm when excited at 470 nm than the intact cells.

41506 Description of a disposable individual-mouse urine collection apparatus. Smith, C.R.; Felton, J.S.; Taylor, R.T. (Lawrence Livermore Lab., CA). *Laboratory Animal Science;* **31**: No. 1, 80-82(Feb 1981). Contract W-7405-ENG-48.

An inexpensive, individual mouse urine collection apparatus was constructed from a 250 ml conical polypropylene centrifuge tube and wire cloth. The construction did not require special tools, and was completed in 1 hour. This apparatus allowed the ad libitum feeding and watering of individual mice during the urine collection period. Volumes of urine collected ranged from 0.5-2.0 ml per 24 hours per 25 g mouse.

41507 Errors in potassium balance. Forbes, G.B.; Lantigua, R.; Amatruda, J.M.; Lockwood, D.H. (Univ. of Rochester Medical Center, NY). *American Journal of Clinical Nutrition;* **34**: 105-109(Jan 1981).

Six overweight adult subjects given a low calorie diet containing adequate amounts of nitrogen but subnormal amounts of potassium (K) were observed on the Clinical Research Center for periods of 29 to 40 days. Metabolic balance of potassium was measured together with frequent assays of total body K by ^{40}K counting. Metabolic K balance underestimated body K losses by 11 to 87% (average 43%): the intersubject variability is such as to preclude the use of a single correction value for unmeasured losses in K balance studies.

41508 Influence of calcitonin on the plasma and urine phosphate changes produced by parathyroid hormone. Talmage, R.V.; VanderWiel, C.J. (Univ. of North Carolina, Chapel Hill). *Calcified Tissue International;* **28**: 113-119(1979). Contract EY-76-S-05-4106.

The influence of calcitonin (CT) on parathyroid hormone-induced changes in plasma phosphate, urine phosphate, plasma ^{32}P and ^{32}P specific activity (^{32}P-S.A.) was studied using thyroparathyroidectomized rats. Radiophosphorus was injected at either 10 h (^{32}P-10 h) or 8 days (^{32}P-8 d) before commencing hormonal treatment. Under these conditions, PTH produced a rise (relative to controls) in plasma ^{32}P-S.A. (-8d) during an 8-h experimental period, while plasma ^{32}P-S.A. (-10 h) fell. Calcitonin treatment alone did not affect plasma ^{32}P-S.A., regardless of when ^{32}P was administered. When both hormones were injected concurrently, CT augmented the PTH-induced hypophosphatemia and magnified the fall in plasma ^{32}P levels, but the addition of CT did not affect PTH-induced changes in either renal calcium or phosphate excretion. However, the PTH-induced changes in plasma ^{32}P-S.A. were abolished. These data could not be explained by the opposing effects of the two hormones on rates of bone resorption. The results add support to the postulate that calcitonin moves phosphate into and prevents its loss from bone and bone fluid.

5506 Medicine

REFER ALSO TO CITATION(S) 40335, 40865, 41229, 41314, 41563

41509 (AD-A—103119/4) Radiometric methods for rapid diagnosis of viral infection. Combined quarterly report No. 1, 1 June-1 December 1974. Larson, S.M.; Charache, P.; Wagner, H.N. Jr. (Johns Hopkins Univ., Baltimore, MD (USA)). 15 Nov 1974. 6p. NTIS, PC A02/MF A01.

A rapid radiometric technique was developed for detecting the presence of herpes simplex virus type 1 in stationary monolayers of the diploid cell line WI-38. The time of detection was compared to that obtained from visual examinations for cytopathic effects in the same cell line. Glucose-1-14C oxidation of infected and uninfected cells was determined by 14CO2 production by the ionization chamber, Bactec R-301. Infected cells showed a 23-26% reduction in glucose-1-14C oxidation 4-6 hours post-infection, as compared to uninfected control cells. This change in cellular metabolism was observed 14 hours before visible signs of cytopathic effect. Specific antiserum will be used to neutralize the viral effect for the purpose of speciation. The radiometric method for the detection of viral effect on host metabolism is simple, objective, and deserves further investigation.

41510 (CNEA—447) Determination of hormone parathyroid by radioimmunoassay. Fisher-Ferraro, C.; Moos de Ephraim, M.; Mautalen, C.; Mitta, A.E.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Oct 1978. 10p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701035.

The labelling of bovine parathyroid hormone and its employment for the determination of seric PTH by radioimmunoanalysis is described. The specific activity of ^{131}I PTH is 200-350mCi/mg and the damage 3-5%. The method used for radioimmunoanalysis was that of C.D. Arnaud and coworkers.

41511 (HRP—0903137/8) Criteria and standards for reviewing the appropriateness of radiation therapy services. (Northeastern Wisconsin Health Systems Agency, Inc., Green Bay (USA)). 5 Mar 1981. 20p. NTIS, PC A02/MF A01.

Six criteria and standards for reviewing the appropriateness of radiation therapy services are defined. The criteria include: (1) minimum number of patients per year required to support a radiotherapy unit; (2) minimum annual number of treatments per piece of megavoltage equipment; (3) minimum population base for radiotherapy services; (4) travel time to radiotherapy services; (5) multi-discipline approach to cancer management; and (6) evaluation of cancer services rendered to patients. Factors, considerations, and sources are identified for all criteria and standards. Adjustments and comments, some discussing rationale, are described for several criteria and standards. Data requirements and sources are outlined for each criterion. A glossary is included. The six service performance characteristics and fourteen general review considerations to be addressed during an appropriateness review, which the National Health Planning and Resources Development Act of 1974 and the Health Planning Amendments of 1979 identify, are listed.

41512 (HRP—0903170/9) A review of disease-based approaches to estimation of need for computed tomographic (ct) services. Lagoe, R. (Central New York Health Systems Agency, Inc., Dewitt (USA)). Mar 1981. 17p. NTIS, PC A02/MF A01.

As the applications of computed tomography (CT) increase, approaches to prediction of need for this technology have multiplied. In recent months, much of this attention has focused on disease-based methodologies. The proliferation of data concerning disease-based approaches has resulted in confusion regarding this topic. This document is intended to clarify that situation. Included in the report is a survey of the development of CT need methodologies, with particular emphasis on disease-based approaches. Also included is a comparative evaluation of the major approaches currently available.

41513 **(HRP—0903472/9) Survey of physician requirements in six specialties: manpower needs in anesthesiology, neurology, nuclear medicine, pathology, physical medicine and rehabilitation, radiology. Final report.** Wills, J. (Battelle Human Affairs Research Center, Seattle, WA (USA)). Jul 1980. 68p. (BHARC—130/80/022). NTIS, PC A04/MF A01.

This report was prepared to assist the Graduate Medical Education National Advisory Committee (GMENAC) in its efforts to model physician manpower requirements in six specialties: anesthesiology, neurology, nuclear medicine, pathology, physical medicine and rehabilitation, and radiology. The purpose of this report is to (1) survey and present the existing literature on manpower requirements in each of these six specialties, and (2) discuss the special problems present in each specialty in modeling manpower requirements, and where possible, suggest possible avenues of resolution.

41514 **(PB—81-139842) Measurement of the potency of allergen extracts by the radioallergosorbent test. Final report, 1 April 1977-31 March 1979.** Gleich, G.J. (Mayo Foundation, Rochester, MN (USA)). Dec 1980. 105p. NTIS, PC A06/MF A01.

A method using radio labelled staphylococcal protein A for the measurement of specific IgG antibodies has been established. This assay is superior to anti-globulin type assays for IgG antibody and does not require purified allergens as does the radio immuno precipitation procedure. Several modifications of the enzyme-linked-immuno-assay for specific IgE antibody have been studied, but this procedure has proven inferior to the conventional RAST assay. RAST technology has been used to isolate and partially characterize purified allergens from Russian thistle pollen and peanuts and has aided in the isolation of a purified Alternaria allergen with a molecular weight of about 30,000. An investigation has been carried out of the possible role of human dander as an allergen. But it was found that human dander and house dust extracts do not share common allergens. An assay has been established for IgE and IgG antibodies to mellitin. It was found that bee keepers have significant elevations in serum IgG antibody to mellitin but that relatively few other people exhibit elevated serum IgE antibody to this substance.

41515 **(PB—81-808446) Radiotherapeutic agents and techniques. 1976-May 1980 (citations from the NTIS data base). Report for 1976-May 80.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 227p. NTIS PC N01/MF N01.

Research reports are cited on the use of gamma rays, x-rays, protons, neutrons, heavy ions, negative pions, and radioisotopes in radiotherapy. The bibliography includes data on particle accelerators, dosimetry, and health physics. The effectiveness of radiation for the treatment of cancer and hyperthyroidism is emphasized. (This updated bibliography contains 222 citations, none of which are new entries to the previous edition.)

41516 **(PB—81-808453) Radiotherapeutic agents and techniques. June 1980-August 1981 (citations from the NTIS data base). Report for June 1980-August 1981.** (National Technical Information Service, Springfield, VA (USA)). Aug 1981. 147p. NTIS PC N01/MF N01.

Research reports are cited on the use of gamma rays, x-rays, protons, neutrons, heavy ions, negative pions, and radioisotopes in radiotherapy. The bibliography includes data on particle accelerators, dosimetry, and health physics. The effectiveness of radiation for the treatment of cancer and hyperthyroidism is emphasized. (This updated bibliography contains 141 citations, all of which are new entries to the previous edition.)

41517 **(PB—81-922800) Oncology overviews: cancer diagnosis and therapy series.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 1981. vp. Paper copy available on Standing Order, Deposit Account required. North American Continent price $2.00/each issue; all others write for quote. Single copies also available in paper or microfiche.

The overview series is a product of the International Cancer Research Data Bank (ICRDB) program of the National Cancer Institute. Each overview publication in this series contains abstracts of articles dealing with topics concerned with therapy. The purpose of these overviews is to facilitate and promote the exchange of information between cancer scientists. The material published in an overview is obtained from Cancerline, an on-line cancer information system. A subscriber to this series will receive approximately ten titles per year. These titles will then be updated either on a 12 or 24 month cycle.

41518 **(PB—81-922803) Radionuclide bone scans in the diagnosis and staging of cancer. Oncology overview.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). Jul 1981. 94p. (NCI/ICRDB/OT—81/03). NTIS PC $6.00/MF$3.00.

Oncology Overviews are a service of the International Cancer Research Data Bank (ICRDB) Program of the National Cancer Institute, intended to facilitate and promote the exchange of information between cancer scientists by keeping them aware of literature related to their research being published by other laboratories throughout the world. Each Oncology Overview represents a survey of the literature associated with a selected area of cancer research. It contains abstracts of articles which have been selected and organized by researchers associated with the field. Contents: Bone scans in breast tumors; Bone scans in central nervous system tumors; Bone scans in endocrine tumors; Bone scans in gastrointestinal tumors; Bone scans in genitourinary tumors; Bone scans in gynecologic tumors; Bone scans in head and neck tumors; Bone scans in hemopoietic and lymphatic tumors; Bone scans in respiratory tract tumors; Bone scans in musculoskeletal tumors; Bone scans in melanoma; Bone scans--general and multisite studies; Bone scans--radiopharmaceuticals and techniques; Bone scans--reviews; Bone scans--pre-clinical studies; Bone scans--historical perspectives.

41519 **(PB—81-922804) Nitroheterocyclic compounds as hypoxic cell radiosensitizers. Oncology overview.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). Jul 1981. 41p. (NCI/ICRDB/OT—81/04). NTIS PC $4.50/MF$4.50.

Oncology Overviews are a service of the International Cancer Research Data Bank (ICRDB) Program of the National Cancer Institute, intended to facilitate and promote the exchange of information between cancer scientists by keeping them aware of literature related to their research being published by other laboratories throughout the world. Each Oncology Overview represents a survey of the literature associated with a selected area of cancer research. It contains abstracts of articles which have been selected and organized by researchers associated with the field. Contents: Mechanism of action of hypoxic cell radiosensitizers; Preclinical studies--In vitro radiosensitizing and toxic effects; Preclinical studies--In vivo radiosensitizing and toxic effects; Clinical studies of hypoxic cell radiosensitizers; and Preclinical studies of other chemical hypoxic cell radiosensitizers.

41520 **(PB—81-929402) Clinical diagnosis and treatment of leukemias and lymphomas. Special listing.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). Apr 1981. 66p. (NCI/ICRDB/SL—423). NTIS PC $5.25/MF$3.00.

The special listing of current cancer research projects is a publication of the INTERNATIONAL CANCER RESEARCH DATA BANK (ICRDB) Program of the National Cancer Institute. Each Listing contains descriptions of onggoing projects in one selected cancer research area. The research areas include: Acute and chronic leukemias; Hodgkin's lymphoma; Non-Hodgkin's lymphomas; Supportive care of leukemias and lymphomas; Cooperative groups; Broad programs.

41521 **(PB—81-929408) Bone, cartilage, and soft tissue tumors. Special listing.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). Jul 1981. 73p. (NCI/ICRDB/SL—432). NTIS PC $5.25/MF$3.00.

This Special Listing of Current Cancer Research Projects is a publication of the International Cancer Research Data Bank (ICRDB) Program of the National Cancer Institute. Each Listing contains descriptions of ongoing projects in one selected cancer research area. The research areas include: Experimental carcinogenesis and related biology; Epidemiological studies; Immunological, metabolical and morphological studies; Diagnosis and prognosis; Preclinical therapy; Clinical therapy; Broad clinical programs and cooperative group studies.

41522 **(PB—81-929409) Clinical diagnostic radiology and radiation therapy. Special listing.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). Aug 1981. 71p. (NCI/ICRDB/SL—435). NTIS PC $5.25/MF$3.00.

This Special Listing of Current Cancer Research Projects is a publication of the International Cancer Research Data Bank (ICRDB) Program of the National Cancer Institute. Each Listing contains descriptions of ongoing projects in one selected cancer research area. The research areas include: Radiologic methods in cancer diagnosis; Radiotherapy methods in cancer treatment; Radiotherapy of specific body sites; Radiation injury and pathology; Radiation dosimetry and dose fractionation studies; Broad cancer radiotherapy programs.

41523 **(PB—81-929410) Preclinical diagnostic radiology and radiation therapy. Special listing.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). Aug 1981. 71p. (NCI/ICRDB/SL—454). NTIS PC $5.25/MF$3.00.

This Special Listing of Current Cancer Research Projects is a publication of the International Cancer Research Data Bank (ICRDB) Program of the National Cancer Institute. Each Listing contains descriptions of ongoing projects in one selected cancer research area. The research areas include: Development of radiologic methods and techniques for cancer diagnosis; Development of radiologic methods and techniques for cancer treatment; Radiation therapy of specific tumor cells, tissues and body sites; Radiation pathology and injury; Radiation dosimetry and dose fractionation studies; Broad programs in diagnostic radiology and radiation therapy.

41524 **(PB—81-929503) Male reproductive system neoplasms. Special listing.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). Jul 1981. 59p. (NCI/ICRDB/SL—428). NTIS PC $5.25/MF$3.00.

This Special Listing of Current Cancer Research Projects is a publication of the International Cancer Research Data Bank (ICRDB) Program of the National Cancer Institute. Each Listing contains descriptions of ongoing projects in one selected cancer research area. The research areas include: Experimental prostate carcinogenesis and related biology; Epidemiology of prostatic neoplasms; Preclinical studies of prostatic cancers; Diagnosis and prognosis of prostatic cancer; Therapy of prostatic cancer; Experimental testicular carcinogenesis and related biology; Epidemiology of testicular cancer; Diagnosis, prognosis and treatment of testicular neoplasms; Penile and other reproductive system neoplasms.

41525 **(PB—82-105412) Radiological health training resources catalog, 1981. Biennial report Aug 79-Aug 81.** Chesemore, K.F. (Bureau of Radiological Health, Rockville, MD (USA)). Aug 1981. 59p. NTIS, PC A04/MF A01.

Within the Bureau of Radiological Health, the Division of Training and Medical Applications is responsible for programs that provide training assistance to State and local radiological health agencies. Toward this end, the Division maintains an extensive collection of training materials that it makes available to borrowers on a free loan basis. In addition to their usefulness to State and local radiological health programs, these materials may be of interest to physicians, university personnel, allied health professionals, scientists, students, and consumers. Titles in this media catalog are limited to radiological health subjects only. They include a variety of topics ranging from basic fundamentals to historical perspectives to current state of the art.

41526 **(PB—82-800368) Radiodiagnostic agents and techniques. 1977-May, 1980 (citations from the NTIS data base). Report for 1977-May 80.** (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 271p. NTIS PC N01/MF N01.

Research reports are cited on the applications of neutrons, protons, x-rays, and radioisotopes to medical diagnosis. The topics cover research on biomedical radiography, scanning and imaging techniques including tomography, production of radiopharmaceuticals, dosimetry and health physics, equipment, and computer applications. (This updated bibliography contains 264 citations, none of which are new entries to the previous edition.)

41527 **(PB—82-800376) Radiodiagnostic agents and techniques. June, 1980-August, 1981 (citations from the NTIS data base). Report for Jun 80-Aug 81.** (National Technical Information Service, Springfield, VA (USA)). Sep 1981. 144p. NTIS PC N01/MF N01.

Research reports are cited on the applications of neutrons, protons, x-rays, and radioisotopes to medical diagnosis. The topics cover research on biomedical radiography, scanning and imaging techniques including tomography, production of radiopharmaceuticals, dosimetry and health physics, equipment, and computer applications. (This updated bibliography contains 137 citations, all of which are new entries to the previous edition.)

41528 **Evaluation of blood--brain barrier permeability changes in rhesus monkeys and man using ^{82}Rb and positron emission tomography.** Yen, C.K.; Budinger, T.F. (Lawrence Berkeley Lab., CA). *Journal of Computer Assisted Tomography;* **5**: No. 6, 792-799(Dec 1981). Contract W-7405-ENG-48.

Dynamic positron tomography of the brain with ^{82}Rb, obtained from a portable generator [^{82}Sr (25 days) -- ^{82}Rb (76 sec)], provides a means of studying blood-brain barrier (BBB) permeability in physiological and clinical investigations. The BBB in rhesus monkeys was opened unilaterally by intracarotid infusion of 3 M urea. This osmotic barrier opening allowed entry into the brain of intravenously administered rubidium chloride. The BBB opening was demonstrated noninvasively using ^{82}Rb and positron emission tomography and corroborated by the accumulation of ^{86}Rb in tissue samples. Positron emission tomography studies can be repeated every 5 min and indicate that dynamic tomography or static imaging can be used to study BBB permeability changes induced by a wide variety of noxious stimuli. Brain tumors in human subjects are readily detected because of the usual BBB permeability disruption in and around the tumors.

41529 **Method for calculation of corneal profile and power distribution.** Doss, J.D. (Los Alamos National Lab., NM); Hutson, R.L.; Rowsey, J.J.; Brown, D.R. *Archives of Ophthalmology (Chicago);* **99**: 1261-1265(Jul 1981). Contract W-7405-ENG-26.

Techniques are described for the calculation of details of corneal profile and optical power distribution along the anterior corneal surface using raw data available from an existing commercial instrument.

41530 **The use of filtering methods to compensate for constant attenuation in single-photon emission computed tomography.** Gullberg, G.T.; Budinger, T.F. (Lawrence Berkeley Lab., CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Bio-Medical Engineering;* **BNE-28**: No. 2, 142-157(Feb 1981). Contract W-7405-ENG-48.

A back projection of filtered projection (BKFIL) reconstruction algorithm is presented that is applicable to single-photon emission computed tomography (ECT) in the presence of a constant attenuating medium such as the brain. The filters used in transmission computed tomography (TCT)-comprised of a ramp multiplied by window functions-are modified so that the single-photon ECT filter is a function of the constant attenuation coefficient. The filters give good reconstruction results with sufficient angular and lateral sampling. With continuous samples the BKFIL algorithm has a point spread function that is the Hankel transform of

the window function. The resolution and statistical properties of the filters are demonstrated by various simulations which assume an ideal detector response. Statistical formulas for the reconstructed image show that the square of the percent-root-mean-square (percent-rms) uncertainty of the reconstruction is inversely proportional to the total measured counts. The results indicate that constant attenuation can be compensated for by using an attenuation-dependent filter that reconstructs the transverse section reliably. Computer time requirements are two times that of conventional TCT or positron ECT and there is no increase in memory requirements.

41531 **Special characteristics and potential for radiopharmaceuticals for positron emission tomography.** Wolf, A.P. (Brookhaven National Lab., Upton, NY). *Seminars in Nuclear Medicine;* **11**: No. 1, 2-12(Jan 1981). Contract AC02-76CH00016.

The lower doses and possibilities for short-term serial studies are part of the advantage of short half-life radionuclides. Biomolecules of all sorts can be labeled with positron emitters without alteration of their biochemical and physiologic activity. By virtue of the annihiliation radiation from the positron emitter they can be located and quantitated in a small volume element of tissue. Present efforts are focused mainly on measuring metabolic rates in the brain and in the myocardium. Assessing receptor-site action in the brain and heart with labeled neuroleptics in under intensive development. Noninvasive methods that will allow us to evaluate the dynamics of such action in disease states and to quantitate the response to therapy can be expected in the near future. Protein synthesis and cell proliferation rates measured in vivo are under study. Synthetic techniqus and the development of both remotely operated and automated procedures yielding positron emitter labeled biomolecules of all sorts, including simple alcohols, sugars, amino acids, steroids, alkaloids, and a host of drugs, made possible a wholly new area in nuclear medicine. The efforts of the next several years served by increasing interest and investments in this area will demonstrate whether the great promise of the organic radiopharmaceuticals labeled with positron emitters will be realized.

5507 Microbiology

REFER ALSO TO CITATION(S) 40224, 40367, 41478, 41485, 41552, 41621, 41693

41532 **(EUR—7539-EN) Photoinduced red-ox reactions in facultative photosynthetic bacteria with special attention to the photosynthetic generation of low-potential reducing equivalents. Final report.** Melandri, B.A. (Bologna Univ. (Italy)). 1981. 51p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

This report presents the scientific results obtained by our group at the University of Bologna in a research program devoted to the elucidation of light-induced production of low reducing equivalents and hydrogen consumption in photosynthetic bacteria. Among the Rhodospirillaceae family, several both wild type and mutant strains of Rhodopseudomonas capsulata have been analyzed in order to direct our efforts towards the detection of strains actively able to photoreduce pyridine nucleotides. Moreover we have investigated the NADH photoproduction during different growth modes with special emphasis to physiological conditions which can be reasonably supposed to be the closest ones to the natural environment in which facultative photosynthetic bacteria are normally operating, i.e. semi-aerobic growth in the light. The photoproduction of low reducing equivalents, which is a prerequisite for hydrogen evolution coupled to nitrogen fixation in photosynthetic bacteria, is a energy demanding process correlated with the presence of the first site of phosphorylation. Since during photoheterotrophic growth in the presence of low oxygen tension the respiratory chain does not possess the first site of oxidative phosphorylation, we had to conclude that photoproduction of pyridine nucleotides is only present during experimental growth conditions far away from the physiological ones, i.e. anaerobic growth in the light or aerobic growth in the dark. This finding is not encouraging because of the technical unfeasibility of employing such bacteria to produce hydrogen at the expense of solar energy without controlling the ambient oxygen pressure. The catabolic uptake of hydrogen by the respiratory chain of R. capsulata has been also studied extensively, utilizing different mutant strains with genetic lesions in specific segments of the branched respiratory system.

41533 **Cleavage sites within the poliovirus capsid protein precursors.** Larsen, G.R. (State Univ. of New York, Stony Brook); Anderson, C.W.; Dorner, A.J.; Semler, B.L.; Wimmer, E. *Journal of Virology;* **41**: No. 1, 340-344(Jan 1982).

Partial amino-terminal sequence analysis was performed on radiolabeled poliovirus capsid proteins VP1, VP2, and VP3. A computer-assisted comparison of the amino acid sequences obtained with that predicted by the nucleotide sequence of the poliovirus genome allows assignment of the amino terminus of each capsid protein to a unique position within the virus polyprotein. Sequence analysis of trypsin-digested VP4, which has a blocked amino terminus, demonstrates that VP4 is encoded at or very near to the amino terminus of the polyprotein. The gene order of the capsid proteins is VP4-VP2-VP3-VP1. Cleavage of VP0 to VP4 and VP2 is shown to occur between asparagine and serine, whereas the cleavages that separate VP2/VP3 and VP3/VP1 occur between glutamine and glycine residues. This finding supports the hypothesis that the cleavage of VP0, which occurs during virion morphogenesis, is distinct from the cleavages that separate functional regions of the polyprotein.

41534 **Restriction map of the single-stranded DNA genome of Kilham rat virus strain 171, a nondefective parvovirus.** Banerjee, P.T. (Univ. of Tennessee, Oak Ridge); Rathrock, R.; Mitra, S. *Journal of Virology;* **40**: No. 1, 118-125(Oct 1981). Contract W-7405-ENG-26.

A physical map of Kilham rat virus strain 171 DNA was constructed by analyzing the sizes and locations of restriction endonuclease-generated fragments of the replicative-form viral DNA synthesized in vitro. BglI, KpnI, BamHI, SmaI, XhoI, and XorII did not appear to have any cleavage sites, whereas 11 other enzymes cleaved the genome at one to eight sites, and AluI generated more than 12 distinct fragments. The 30 restriction sites that were mapped were distributed randomly in the viral genome. A comparison of the restriction fragments of in vivo- and in vitro-replicated replicative-form DNAs showed that these DNAs were identical except in the size or configuration of the terminal fragments.

41535 **Thermoanaerobacter ethanolicus gen. nov., spec. nov., a new, extreme thermophilic anaerobic bacterium.** Wiegel, J.; Ljungdahl, L.G. (Univ. of Georgia, Athens). *Archives of Microbiology;* **128**: 343-348(1981). Contract AS09-79ER10499.

Two strains, JW200 and JW201, of an extreme thermophilic, non-spore-forming anaerobic bacterium were isolated from alkaline and slightly acidic hot springs located in Yellowstone National Park. Both strains were peritrichously flagellated rods. Cell size varied from 0.5-0.8 by 4-100 μm; coccoid-shaped cells of about 1 μm in diameter frequently occurred. Division was often unequal. Spheroplast-like forms were visible at the late logarithmic growth phase. The Gram reaction was variable. The DNA base composition of the two strains was between 37 and 39 mol % guanine plus cytosine as determined by buoyant density measurements and approximately 32% by the thermal denaturation method. The main fermentation products from hexoses were ethanol and CO_2. Growth occurred between 37 and 78°C and from pH 4.4 to 9.8. The name Thermoanaerobacter ethanolicus gen. nov., spec. nov. was proposed for the two, new isolates. Strain JW200 was designated as the type strain.

41536 **Antiviral properties of polyinosinic acids containing thio and methyl substitutions.** Chan, E.W.; Lee, C.K.; Dale, P.J.; Northridge, K.R.; Hom, S.S.; Seed, T.M. (Argonne National Lab., IL). *Journal of General Virology;* **52**: 291-299(1981). Contract W-31-109-ENG-38.

Polyinosinic acids containing methyl and sulphur substitutions are potent inhibitors of reverse transcriptase. Substitution of sulphur for oxygen at the 6 position produces significant effects on the properties of polyinosinic acid: the kinetics of inhibition change from competitive to mixed-type and the inhibition constant falls by

three orders of magnitude. In contrast, 1-methyl substitution produces no such effects. Poly(1-methyl-6-thioinosinic acid) or poly(m^1s^6I) inhibits irreversibly, inhibiting all ten reverse transcriptases tested under a variety of assay conditions. In cell culture test systems, poly(m^1s^6I) is capable of blocking both infection by nontransforming viruses and transformation by a sarcoma virus. The presence of poly(m^1s^6I) in a preinfected culture results in the production of non-infectious virus particles lacking reverse transcriptase activity.

41537 **Phycobilisome ultrastructure and chromatic adaptation in Fremyella diplosiphon.** Rosinski, J.; Hainfeld, J.F.; Rigbi, M.; Siegelman, H.M. (Brookhaven National Lab., Upton, NY). *Annals of Botany (London);* **47**: 1-12(1981).

Phycobilisomes isolated from the cyanobacterium Fremyella diplosiphon were negatively stained with uranyl sulphate and examined by transmission and scanning transmission electron microscopy. They were composed of a central triangular core of discs and six peripheral stacks of discs radiating out from the core. The peripheral stack discs were identified as phycobiliprotein hexamers on the basis of their size and morphology. Phycobilisomes from cells grown under white light were compared with phycobilisomes from cells grown under red light. The two types of phycobilisomes differed widely in their phycobili-protein composition, but were closely similar in structure, varying only in the number of peripheral stack discs. The structure described here for F. diplosiphon phycobilisomes is consistent with a recently proposed model for cyanobacterial phycobilisomes.

41538 **Growth and purification of SV40 virus for biochemical studies.** Rosenberg, B.H.; Deutsch, J.F.; Ungers, G.E. (Sloan-Kettering Inst., Rye, NY). *Journal of Virological Methods;* **3**: 167-176(1981). Contract AC02-79EV1026.

A detailed growth and purification scheme suitable for producing relatively large quantities of fully active, pure SV40 is presented together with data on recovery and purity at each step of the procedure. The scheme was designed to prevent the initial binding of virus to cell components as well as contamination of the extracted virus by cellular DNA.

41539 **A dynamic model for in vivo virus replication.** MacCarthy, J.E.; Kozak, J.J. (Univ. of Notre Dame, IN). *Journal of Theoretical Biology;* **90**: 265-281(1980).

In this paper a dynamic model of in vivo virus replication is presented. Kinetic equations are formulated to describe the overall process of replication and then analyzed using a "synergetic" approach. First the importance of a rate-limiting substrate is taken explicitly into account, and secondly the coupling between the processes considered (translation, replication and assembly) is strictly preserved; the analysis itself is carried out in the linear regime. The problems of defective-particle infections, standard-virus infections, inhibition of cellular synthesis, and the case of co-infected cells are treated. The various parameters of the model (initial cellular concentrations, rate constants) are specified using existing experimental data and the full (numerical) consequences of the model are explored in detail. The simple model developed is able to account qualitatively, and occasionally quantitatively, for the behavior observed experimentally for each of the problems cited above.

41540 **Morphological model of the surface-layer array in Spirillum serpens.** Glaeser, R.M. (Univ. of California, Berkeley); Chiu, W.; Grano, D.; Taylor, K. pp 22-26 of Electron microscopy at molecular dimension. Baumeister, W.; Vogell, W. (eds.). Berlin, Germany; Springer-Verlag (1980). Contract W-7405-ENG-48.

A morphological model of the structure of the surface layer of the gram-negative bacterium Spirillum serpens has been developed on the basis of electron microscopy, using unfixed, unstained, frozen hydrated specimens. This model can be used to interpret and account for a wide variety of side views that can be seen in negatively stained specimens as well as in frozen hydrated specimens. This model differed from an earlier model proposed by Buckmire and Murray, and both models were used for the analysis of the diffraction patterns of tubular forms of the surface layer material. A comparison between the calculated diameter of each model compared with observed data for structure indicated that the morphological model of the HP protein established that the structure consists of a number of subunits going around the circumference of a cylinder. (BLM)

5508 Morphology

41541 (LMF—91, pp 198-201) **Bronchoscopy of the chimpanzee.** Muggenburg, B.A.; Hahn, F.F.; Bice, D.E.; Harris, D.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

This study evaluated the chimpanzee as a suitable laboratory animal for experimental studies of the lung. Repeated bronchoscopic procedures were performed on five adult, male chimpanzees. The gross anatomy of the airways resembled that of man. The bronchoscope was maneuvered into the lobar bronchi and into at least two branches of each lobar airway. Cells were obtained by lobar washes through the bronchoscope. Histological examination of a lung showed that brochial glands extended down the airways to the tertiary bronchi. Overall, we judged the chimpanzee a good laboratory animal for experimental studies of the lung, especially if bronchoscopy is involved.

5509 Pathology

REFER ALSO TO CITATION(S) 41586, 41604, 41682

41542 (LMF—91, pp 423-427) **Effects of oxygen toxicity and elastase-induced emphysema on pulmonary function and morphology.** Harkema, J.R.; Mauderly, J.L.; Hahn, F.F. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The functional and morphologic effects of oxygen toxicity in emphysematous rat lungs were evaluated. Emphysema was induced with intratracheally instilled elastase. The effects of O_2 toxicity were induced by exposing rats to 100% O_2 for 48 hours at 1 atm. Separate elastase and oxygen treatments induced distinctly different disease models. Combined treatments induced certain features of both diseases. Hyperoxia did not enhance existing emphysematous lesions and the effects of O_2 toxicity were not different in elastase-treated rats compared to normals.

41543 **Cellular kinetics in a patient with Sezary syndrome.** Chandra, P.; Chanana, A.D.; Chikkappa, G.; Cronkite, E.P. (Brookhaven National Lab., Upton, NY). *American Journal of Hematology;* **10**: 327-339(1981). Contract AC02-76CH00016.

Cellular kinetics and proliferation of Sezary cells (SC) were studied in a 48-year-old woman with Sezary syndrome (SS). In vitro flash labeling indices of peripheral blood (PB) SC were studied by labeling with tritiated thymidine (^{3}HTdR) and tritiated cytidine (^{3}HCdR). Intradermal SC were labeled in vivo by local injection of ^{3}HTdR followed by skin biopsies of the injected sites. Traffic patterns of DNA labeled PB SC were studied by intravenous ^{3}HTdR followed by sampling of PB, skin, lymph node (LN), and bone marrow (BM). Fluxes of PB SC in various tissues were investigated by autotransfusion of ^{3}HCdR labeled PB SC followed by serial sampling of PB, LN, BM, and skin. In vitro response of PB SC to phytohemagglutinin (PHA), concanavalin A (Con A), and pokeweed (PWM) were also investigated. The results from these studies in this patient indicate that 1) proliferation of SC was primarily in the skin, 2) there was a negligible flux of SC from blood into skin, LN, and BM, and 3) the mitogenic response of PB mononuclear cells (mostly SC) to PHA, PWM, and Con A was poor.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 41186, 41529, 41559, 41635, 41718, 41719,

41720

41544 (LMF—91, pp 202-205) **Influence of driving pressure during forced expiration of rats.** Mauderly, J.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The appropriate definition of maximal expiration in anesthetized rats was studied by performing forced expirations using driving pressures ranging from ambient to -60 cm H_2O. Families of flow-volume curves at different driving pressures were plotted for four normal adult rats. Peak flow rate increased with each increase in driving pressure in two rats; however, -50 cm H_2O gave higher peak flow rates than -60 cm H_2O in the other two. In all rats, flow rates at lower lung volumes increased with driving pressure to maximal and then decreased with further increases in pressure. This effect was greatest at 50% of vital capacity. The driving pressure to achieve maximal flow rates, therefore, depends on the lung volume of greatest interest.

41545 (LMF—91, pp 415-418) **Recruitment of immune cells produced in distant lymphoid tissues to the lung.** Bice, D.E.; Hillam, R.P.; Muggenburg, B.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Results of our previous studies with dogs indicate that immune cells in lavage fluid are produced in the thoracic lymph nodes and are recruited from the lung vasculature into the immunized lung lobes. The present study was designed to determine if the tissue source of immune cells affects their recruitment to the lung. The data obtained indicated that antibody-forming cells produced in the popliteal lymph nodes were recruited to the lung at the same rate as immune cells produced in the thoracic lymph nodes.

41546 (LMF—91, pp 419-422) **Effects of inflammatory agents on cell recruitment to the lung of Beagle dogs.** Hillam, R.; Bice, D.E.; Muggenburg, B.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Four agents that should differ in their macrophage chemotactic and activation potentials were used to study the possible roles played by inflammation in the recruitment of lymphocytes to the lung of Beagle dogs. Zymosan, a poorly immunogenic particle capable of activating the alternate complement pathway, was more effective in recruiting sensitized lymphocytes than were sheep red blood cells (SRBC), the initiator of the immune response being monitored. Lung lobes exposed to SRCB or polystyrene latex beads contained more immune cells than lung lobes exposed to bovine serum albumin (BSA). However, all agents, including BSA, did have a greater effect on cell recruitment than saline. Lymphocyte accumulation followed inflammatory-induced alveolar macrophage infiltration.

41547 **Body composition and dietary intake in neoplasic disease.** Cohn, S.H. (Brookhaven National Lab., Upton, NY); Gartenhaus, W.; Vartsky, D.; Sawitsky, A.; Zanzi, I.; Vaswani, A. Yasummure, S.; Rai, K.; Cartes, E.; Ellis, K.J. *American Journal of Clinical Nutrition;* **34**: 1997-2004(Oct 1981). Contract AC02-76CH00016.

Changes in body composition in 37 cancer patients were studied over a period of 6 months. Initially, the patients were divided into two groups: those who lost body weight (over 10%) and those who maintained or gained body weight before the study. Analysis of body composition indicated that patients who lost body weight has caloric and protein intakes markedly below "normal" levels at the beginning of the study. There also appears to be a direct relationship between the protein intake and the total body potassium/total body water ratio in the cancer patients. At the end of the 6-month study, the patients were again placed into two groups on the basis of weight loss or gain (and maintenance). Changes in body composition over the period were analyzed in terms of lean body mass, its protein constituent, water, and fat. Weight loss was found to reflect primarily the loss of fat, water, lean body mass (potassium), and only to a minor extent the protein component of lean body mass (nitrogen). Further, on the basis of the values of the ratios of total body nitrogen/total body potassium/total body water, it was possible to ascertain the relative normalcy of the body tissue gained or lost in the 6-month period. The results of the study suggest that the ratio total body nitrogen/total body potassium may serve as the best indicator of recent or ongoing catabolism or anabolism of the neoplastic process. By means of the application of the techniques used for the determination of body composition, it should be possible to assess regimes of hyperalimentation of cancer patients who lose body weight. (JMT)

41548 **Mechanisms of passive potassium influx in corn mitochondria.** Fluegel, M.J.; Hanson, J.B. (Univ. of Illinois, Urbana). *Plant Physiology;* **68**: 267-271(1981). Contract AC02-76EV00790.A005.

Corn mitochondria in 100 millimolar KCl show accelerated passive swelling upon addition of uncoupler. This unusual response has been compared with swelling produced by valinomycin, tripropyltin, and nigericin. It is concluded that the driving force for swelling lies with the chloride gradient and a high P /sub cl/:P/sub k/ ratio, the chloride influx creating a negative membrane potential. The action of uncoupler is to facillitate K^+ influx via the endogenous H^+/K^+ antiporter. The antiporter is active over the pH range 6 to 8, is not sensitive to mg^{2+} concentration, and is not inactivated by aging. It is not clear why corn mitochondria show this exceptional activity of the H^+/K^+ antiporter in K^+ influx. It is speculated that during isolation the antiporter may be exposed or activated, and that it contributes to cyclic K^+ transport and high State 4 respiration rates.

41549 **Plasma clot-promoting effect of collagen in relation to collagen-platelet interaction.** Gentry, P.A. (Comparative Animal Research Lab., Oak Ridge, TN); Schneider, M.D.; Miller, J.K. *American Journal of Veterinary Research;* **42**: No. 5, 708-715(1981). Contract AC05-760ROO242.

The hemostatic function of several acid-soluble collagen preparations and a fibrillar-form collagen preparation have been compared. Pepsin-treated acid-soluble collagen isolated from burro and horse aortic tissue and acid-soluble colagen isolated from human umbilical cord readily promoted platelet aggregation, but failed to activate the coagulation mechanism even after prolonged incubation with plasma at 37 C. By contrast, fibrillar-form collagen isolated from burro aorta was both an efficient stimulant for the induction of platelet aggregation and a potent clot-promoting agent. Similar results were found for all the collagen preparations irrespective of whether the studies were conducted with sheep or with burro plasma. Heat denaturation studies showed that the hemostatic functon of the fibrillar-form colagen was dependent on an intact tirple-helical structure.

41550 **α-Methylglucoside satisfies only Na^+-dependent transport system of intestinal epithelium.** Kimmich, G.A.; Randles, J. (Univ. of Rochester Medical Center, NY). *American Journal of Physiology;* **241**: C227-C232(1981). Contract AC02-76EVO3490.

The unidirectional influx of α-methylglucoside (α-MG) by isolated chicken intestinal epithelial cells is 98% inhibited by phlorizin. The remaining 2% of the total influx occurs in the absence of Na^+, is not sensitive to phloretin, and is equal to the diffusional entry rate for 2-deoxyglucose. The glucoside is much more strongly accumulated (75-fold) than 3-O-methylglucose (3-OMG) (10-fold). Inhibitors of the serosal sugar carrier (phloretin, cytochalasin B, theophylline, and flavanoids) do not enhance α-MG accumulation. It is concluded that the glycoside is not a substrate for the intestinal serosal transport system. Steady-state gradients of the sugar can be represented accurately by a concentrative, phlorizin-sensitive system that is opposed by a diffusional efflux process.

41551 **Uptake of [^{3}H]colchicine into brain and liver of mouse, rat, and chick.** Bennett, E.L. (Lawrence Berkeley Lab., CA); Alberti, M.H.; Flood, J.F. *Pharmacology, Biochemistry and Behavior;* **14**: No. 6, 863-869(1981). Contract W-7405-ENG-48.

The uptake of [ring A-4-^{3}H] colchicine and [ring C-methoxy-^{3}H]colchicine has been compared in mice from 1 to 24 hr after

administration. Less radioactivity was found in brain after administration of ring-labeled colchicine than after administration of the methoxy-labeled colchicine. Three hr after administration of ring-labeled colchicine, 5% of the label was in liver and about 0.01% of the label was present in brain. Forty percent of the brain radioactivity was bound to tubulin as determined by vinblastine precipitation. After 3 hr, an average of 8% of the radioactivity from methoxy-labeled colchicine was found in the liver and 0.16% in brain. However, less than 5% of the activity in brain was precipitated by vinblastine, and the colchicine equivalent was comparable to that found after administration of the ring-labeled colchicine. The amount of colchicine entering mouse brain after subcutaneous injection is comparable to the minimum behaviorally effective dose when administered to the caudate. The metabolism of [ring C-methoxy-^{3}H] and [ring A-^{3}H]colchicine was also studied in rats. The general pattern was similar to mice; less radioactivity was found in brain after administration of the ring-labeled alkaloid than after administration of methoxy-labeled colchicine. Again, 40-50% of ring-labeled colchicine was precipitated by vinblastine. A much smaller percentage of the methoxy-labeled drug was precipitated by vinblastine than of the ring A-labeled colchicine. These experiments, together with behavioral experiments, support the hypotheses that structural alterations in synapses by recently synthesized proteins which are transported down the axons and dendrites may be an essential process for long-term memory formation.

41552 **Pyropheophytin a accompanies pheophytin a in darkened light grown cells of Euglena.** Schoch, S. (Brandeis Univ. Waltham, MA); Scheer, H.; Schiff, J.A.; Rudiger, W.; Siegelman, H.W. *Zeitschrift fuer Naturforschung, Teil C: Biochemie, Biophysik, Biologie, Virologie;* **36**: 827-833(1981).

Light-grown non-dividing cells of Euglena gracilis Klebs var. bacillaris Cori form pheophytin a like pigments from chlorophyll a without loss of viability when they are allowed to incubate in darkness without shaking. This is accompanied by the loss of long-wavelength components in the red absorption band of intact cells. After extraction of these cells with acetone, transfer of the pigments to ether and treatment of the ether solution with dilute acid, two pigments can be separated by high performance liquid chromatography on reverse pase silica gel (RP-8) using methanol:water = 95:5 (v/v) as the eluting solvent: In addition to pheophytin a, the eluate contains an unknown pigment. With increasing times of incubation of the cells in darkness, the proportion of phenophytin a decreases and the proportion of the unknown increases suggesting, that the unknown is formed from pheophytin a. This pigment has been identified as pyropheophytin a. It has the same absorption spectrum as pyropheophytin a (propared by pyridine pyrolysis of pheophytin a) and contains phytol as the long-chain esterifying alcohol. On conversion to the methyl ester, the resulting methyl phorbide is identical with authentic pyromethylpheophorbide a by tlc, hplc, absorption, absorption differences and mass spectroscopy. This is the first report of pyropheophytin a or any pyrochlorophyll derivative from plants or oxygenic plant-like microorganisms where it may serve as an intermediate in chlorophyll degradation.

41553 **Perferential loss of thin filaments during molt-induced atrophy in crab claw muscle.** Mykles, D.L. (Univ. of Tennessee, Oak Ridge); Skinner, D.M. *Journal of Ultrastructure Research;* **75**: 314-325(1981). Contract W-7405-ENG-26.

The closer muscle of the claw of a land crab Gecarcinus lateralis consists of slow, or tonic, fibers that undergo a sequential atrophy and restoration during each molting cycle. We have examined the ultrastructural organization of claw fibers during the process of protein degradation that takes place in proecdysial muscle atrophy. The myofibrial cross-sectional area is reduced fourfold by dissolution of peripheral myofilaments and by focal erosion within the fibrila. As degradation continues, there is a preferential loss of thin filaments relative to thick filaments: (1) the average distance between thick filaments decreases from 59 to 45 nm, causing a 72% increase in packing density of thick filamets in cross section and (2) the relative numbers of thin and thick filaments decrease from an average ratio of 9:1 to 6:1. Despite these significant structural changes, the general organization of the arcomere is unaltered; the membrane surface density of the sacroplasmic reticulum and the A-band length remain unchanged. Although there is autophagy of some mitochondria, others retain their normal apperance, as do the nuclei. These data suggest that the specific degradation of contractile proteins in proecdysial atrophic muscle includes the differential breakdown of thin vesus thick filaments.

41554 **Liposome-encapsulatd desferrioxamine in experimental iron overload.** Lau, E.H.; Cerny, E.A.; Rahman, Y.E. (Argonne National Lab., IL). *British Journal of Haematology;* **47**: 505-518(1981). Contract W-31-109-ENG-38.

Desferrioxamine (DF) was encapsulated in multilamellar liposomes (ML) and unilamellar liposomes (UL). Liposomes were prepared either with or without a glycolipid, i.e. galactocerebroside (GC). The average diameter of ML was 0.5 μm, and that of UL was 0.08 μm. Less than 5% of DF leaked out from the liposomes after incubation in mouse plasma for 6 h. ^{59}Fe-ferritin and ^{59}Fe-labelled heat damages erythrocytes (^{59}Fe-DRBC) were administered to normal and hypertransfused mice as models of iron overload Ferritin was used to label liver parenchymal cells and DRBC to label the Kupffer cells of the liver. A single injection of ML or UL with or without galactocerebroside into normal and hypertransfused mice enhanced from 3-to 15-fold the urinary excretion of radioiron from ^{59}Fe-ferritin injected mice than liposomes without the glycolipid; whereas liposomes without GC removed more ^{59}Fe radioactivity from mice receiving ^{59}Fe-DRBC. Thus GC-liposomes may have a higher affinity for parenchymal cells of the liver, whereas liposomes without the glycolipid may have a higher uptake by the Kupffer cells.

41555 **Responses of the osteocyte lining cell complex. The bone cell unit to calcitonin.** Matthews, J.L.; Talmage, R.V.; Doppelt, S.H. (Baylor Univ., Dallas, TX). *Metabolic Bone Disease and Related Research;* **2**: 113-122(1980). Contract EY-76-S-05-106.

A calcium phosphate complex forms in the lacunar and canalicular spaces following calcitonin administration. This complex is demonstrated morphologically by potassium and pyroantimonate fixation or by incubation of tissue in aqueous medium for up to 9 days. This latter treatment results in a transformation of the calcium phosphate complex and free ions to mineral crystals. Specimens viewed with transmission electron microscopy at 15 minutes after hormone administration show a maximal presence of this complex. By 30 minutes post-hormone and post-incubation the amount of mineral crystals observed is reduced to a minimal amount. The amount of this complex observed at 1 and 2 hours after calcitonin then increases. Incubation of the 30 minutes post-hormone specimens in an acidic medium enhances conversion to crystals while incubation in a basic medium is without effect. This observation confirms that available electrolytes and other necessary elements are present at the 30 minutes post-calcitonin period, but an acid milieu is necessary to achieve crystal formation. In addition, marked changes in lining cell configuration as shown with both SEM and TEM consistently accompanied calcitonin administration.

41556 **Study of the action of calcitonin by its effects on lead-induced hypercalcemia.** Talmage, R.V.; VanderWiel, C.J. (Univ. of North Carolina, Chapel Hill). *Calcified Tissue International;* **29**: 219-224(1979). Contract EY-76-S-05-4106.

Intravenous (i.v.) injection of lead acetate produces an immediate elevation in total plasma calcium and phosphate levels. This is due to the formation of calcium-phosphate compounds which can be removed by centrifugation at 25,000 x g. For this study, the effect of salmon calcitonin (CT) on these lead-induced plasma changes was studied. Intact male rats were injected i.v. with lead acetate 10 to 30 mg/kg. CT (0.1 to 0.2 mU/g) injected 30 min prior to lead modified the lead-induced plasma changes as follows: the concentration of lead remaining in plasma was statistically reduced. This was accompanied by a decrease in the amount of colloidal calcium-phosphate removed by ultracentrifugation and a corresponding decrease in the lead-induced elevation of total plasma calcium and phosphate levels. This action of CT was still effective in acutely nephrectomized rats. However, a 15-day pretreatment with a diphosphonate abolished the hypocalcemic effect of CT and also abolished the ability of CT to affect the lead-induced plasma changes. Finally, CT was ineffective if injected in as short a time period as 30 min after lead injection. It is concluded from these

studs that CT causes a rapid sequestering of lead from plasma into specific sites in bone.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 41504

41557 (GKSS—79/E/53) Collected results of the studies on artificial food chains: Project Marine Bioproduktion. Koske, P.H.; Kuhlmann, D.; Lenz, J.; Nellen, W.; Quantz, G.; Queisser, C.; Witt, U. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1980. 86p. Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt mbH, 2054 Geesthacht, Germany.

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The present volume covers results of studies on artificial food chains which have been performed during the years 1976 to 1979 within the project Marine Bioproduktion. The research work was done in cooperation between GKSS, Institut fuer Werkstofftechnologie und Chemie, and the Institut fuer Meereskunde of the University Kiel, departments fish biology and planktology. Besides work on process engineering with regard to sea water supply, aeration and use of the incident irradiation first results on the primary production, the consumption by secondary producers and on the growth of fry are reported on a semi-technical level.

41558 IVDMD, total sugars, and lignin measurements on normal and brown midrib (bmr) sorghums at various stages of development. Hanna, W.W.; Monson, W.G.; Gaines, T.P. (Univ. of Georgia Coastal Plain Station, Tifton). *Agronomy Journal;* **73**: 1050-1052(Nov 1981). Contract AS09-76EV00637.

Reduced lignin concentrations found in brown midrib (bmr) mutants of sorghum, Sorghum bicolor (L.) Moench., have great potential for increasing the in vitro dry matter digestibility (IVDMD) of sorghum forage. The objective of this study was to determine the effects of five bmr mutants on IVDMD, lignin concentration and total sugars of young vegetative forage that would be used for grazing or hay. Forage from bmr 12 and bmr 18 harvested 4 weeks after planting was significantly higher in IVDMD than their normal counterparts in each of the 3 years tested. Three other mutants were not consistently higher in IVDMD indicating a possible environmental interaction. Total reducing and non-reducing sugars were not related to IVDMD and the bmr mutants did not have a significantly different total sugar concentration than normal types. Four weeks after planting, IVDMD of bmr 12 forage was 7.2 and 5.6 percentage units higher than normal forage for leaves and stems, respectively. The differences observed for the bmr gene should lead to significant improvement in animal performance.

41559 The energy and mass exchange characteristics of a loblolly pine plantation. Murphy, C.E. Jr.; Schubert, J.F.; Dexter, A.H. (Savannah River Lab., Aiken, SC). *Journal of Applied Ecology;* **18**: 271-281(1981). Contract AC09-76SR00001.

Energy balance measurements based on Bowen ratio techniques were used in conjunction with the big-leaf model to characterize energy and mass exchange between the atmosphere and the forest canopy in a loblolly pine plantation. The partitioning of net radiation into latent and sensible heat by the Bowen ratio varied greatly with time of day and from day to day even when measured at the same time of day. Such variation results from variations in net radiation, canopy resistance, and air vapour density deficit. The maximum Bowen ratio during daylight hours was 2.3 and the minimum 0.11. Canopy conductance was significantly correlated with solar radiation flux density in the canopy. Significant correlations were found between average stomatal conductance (calculated from canopy resistance and leaf area index) and leaf temperature, vapour density deficit, and solar radiation flux in the canopy.

41560 Development of a national electronic identification system for livestock. Holm, D.M. (Los Alamos National Lab., NM). *Journal of Animal Science;* **53**: No. 2, 524-530(1981).

The USDA has been supporting the development of a National Electronic Identification System for livestock since 1973, because widespread use of such a system would improve disease control. This would be accomplished through the maintenance of more extensive and accurate records that could allow for a rapid tracing of diseased animal movements in commerce and rapid implementation of appropriate control measures. It appears that the major technical problems of developing the system have been surmounted, and plans are being implemented to purchase and field test some commercial equipment that will have most of the properties thought necessary for the National System. The National Electronic Identification Board has been formed with representatives from all of the major livestock interests to guide the development of the program, so that the total livestock industry will benefit through improved management and better disease control with a single voluntary National System.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 40316, 40317, 40334, 41215, 41226, 41427, 41429, 41447, 41541, 41544, 41707, 41888, 41888

41561 (AD-A—097732/2) Consideration of initial nuclear radiation in an attack on a civilian population. Final report, 28 July 1977-30 November 1979. Gasten, B.R. (National Bureau of Standards, Washington, DC (USA)). Mar 1980. 71p. NTIS PC A04/MF A01.

For megaton-yield weapons, the primary prompt casualty producing effect is blast. Hence, in the past, when the most likely attack on a large city was by large weapons, most studies undertaken failed to include the effects of initial nuclear radiation (INR). However, current attack studies must include the likelihood of smaller-yield weapons, those of the order of tens of kilotons, and therefore, INR must be considered. This study was undertaken to examine the casualties resulting from INR in addition to those caused by blast. The ANDANTE computer model, maintained by the Federal Emergency Management Agency was used in this study. Graphs were developed that demonstrated the protection against initial nuclear radiation, the initial protection factor, that would limit the increase in deaths due to the inclusion of radiation to given percentages over that resulting only from blast as a function of the blast protection of the population. It was confirmed that radiation protection becomes very important for attacks by low-yield weapons. For 5-kt weapons, radiation protection was needed to limit additional deaths to 10% when shelters were such that half of the population or less would be fatally injured when overpressures exceeded 7.5 psi. For 40-kt weapon attacks, radiation protection was needed when shelters protected 50% or more of the population against 11 psi or greater. Radiation protection was needed for 15-psi or stronger shelters for attacks by weapons with 200-kt yields, and for 25 psi or stronger shelters for 1-Mt weapons.

41562 (AD-A—103814/0) Army medical research and development technical report. Annual progress report 1 Oct 79-30 Sep 80. (Armed Forces Inst. of Pathology, Washington, DC (USA)). 1 Oct 1980. 10p. NTIS, PC A02/MF A01.

The U.S. Army is conducting contractual studies on the wholesomeness for human consumption of radiation sterilized meat. Pathological results obtained from experimental animals will be statistically analyzed and submitted together with other experimental data to the FDA and USDA to establish a regulation permitting unlimited consumption of radiation sterilized meat. The AFIP serves as monitor and reviewer of the pathologic findings in the contractor's experimental and control animals.

41563 (DOE/EV/01105—282) V79 survival following simultaneous or sequential irradiation by 14.8-MeV neutrons and ^{60}Co photons. Higgins, P.D.; DeLuca, P.M. Jr.; Pearson, D.W.; Gould, M.N. (Wisconsin Univ., Madison (USA)). 1981. Contract AS02-76EV01105. 21p. NTIS, PC A02/MF A01. Order Number DE82009365.

A unique tandem source irradiation facility, comprised of an intense d-T neutron source and a ^{60}Co teletherapy unit, has been used to investigate biological response for different neutron/photon configurations. V79 Chinese hamster cells, attached as monolayers in log phase growth, were irradiated at 37°C by either 14.8 MeV neutrons, ^{60}Co or by a mixture of 40% neutrons - 60% photons in simultaneous or sequential application. Measurements of cell survival indicate an increased effectiveness in cell killing for simultaneously administered neutrons and photons than was measured or predicted for sequentially applied beam modalities. An understanding of the magnitude of these interactive effects is important both for calculating accurate effective doses for neutron radiotherapy of deep-seated tumors, for which the photon component is appreciable and for determination of environmental hazards to people occupationally exposed to low levels of photons and neutrons.

41564 (DOE/EV/01105—283) **Semi-phenomenological method for applying microdosimetry in estimating biological response.** Higgins, P.D.; DeLuca, P.M. Jr.; Pearson, D.W.; Gould, M.N. (Wisconsin Univ., Madison (USA)). 1981. Contract AS02-76EV01105. 18p. NTIS, PC A02/MF A01. Order Number DE82009367.

A semi-phenomenological approach has been used to estimate cell survival on the basis of microdosimetrically obtained measurements of beam quality, together with determinations of the biological cytotoxic response parameters of V79 Chinese hamster cells. Cells were exposed to a field of minimally ionizing radiation and to fields at least partially comprised of high LET radiation. We show that for widely varying experimental conditions, we can predict, with good reliability, cell survival for any arbitrary known beam quality and with a minimum of biological input.

41565 (HRP—0902935/6) **Problems in assessing the cancer risks of low-level ionizing radiation exposure. Volume 1. Report to the Congress.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 2 Jan 1981. 97p. (EMD—81-1-VOL-1). NTIS PC A05/MF A01.

After decades of research, important questions remain unanswered about the cancer risks of low-level ionizing radiation exposure. With the increasing use of materials and processes that produce ionizing radiation, it has become more important to resolve these questions. Medical diagnosis and therapy, mining, certain building materials, fallout from nuclear weapons tests, and the nuclear power cycle are among the many sources of ionizing radiation. The uncertainties in this area pose particular problems for Federal agencies in deciding how best to spend limited research dollars. GAO believes that continued Federal research is necessary, and offers recommendations to strengthen this effort.

41566 (HRP—0902936/4) **Problems in assessing the cancer risks of low-level ionizing radiation exposure. Volume 2. Report to the Congress.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 2 Jan 1981. 680p. (EMD—81-1-VOL-2). NTIS PC A99/MF A01.

Contents: Radiation and biology; Radiation and human populations; Radiation and the federal government.

41567 (INIS-mf—6799) **Application of atomic energy in agriculture. Annual Report 1980.** (Association Euratom-ITAL, Wageningen (Netherlands)). 1981. 158p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE82780401.

The activities of the Institute in 1980 are reported in a series of reports from the following research groups: Contamination, plant nutrition-soils, properties of crop plants, crop protection and product treatment.

41568 (KFK—3110) **Medical treatment of radiation damages and medical emergency planning in case of nuclear power plant incidents and accidents.** Ohlenschlaeger, L. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Medizinische Abt.). Mar 1981. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82780372.

Medical measures in case of radiation damages are discussed on the basis of five potential categories of radiation incidents and accidents, respectively, viz. contaminations, incorporations, external local and general radiation over-exposures, contaminated wounds, and combinations of radiation damages and conventional injuries. Considerations are made for diagnostic and therapeutic initial measures especially in case of minor and moderate radiation accidents. The medical emergency planning is reviewed by means of definations used in the practical handling of incidents or accidents. The parameters are: extent of the incident or accident, number of persons involved, severity of radiation damage. Based on guiding symptoms the criteria for the classification into minor, moderate or severe radiation accidents are discussed. Reference is made to the Medical Radiation Protection Centers existing in the Federal Republic of Germany and the possibility of getting advices in case of radiation incidents and accidents.

41569 (LMF—91, pp 18-21) **Effects of Pu-U elemental ratio on the distribution of inhaled mixed (U-Pu)O_2 aerosols in rats.** Kanapilly, G.M.; Boecker, B.B. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Inhalation studies are in progress in rats that inhaled $^{239}PuO_2$, $^{233}UO_2$ or one of five mixed (U-Pu)O_2 aerosols ranging from 0.9 to 35 percent Pu. Tissue contents of Pu at 4, 32, 128 and 256 days after exposure are presented. It appears that the Pu to U mass ratio affects the rates of translocation from the lung slightly. The highest rate of Pu translocation was associated with the lowest Pu ratio (0.9 percent Pu in (U-Pu)O_2). Uranium appears to leave the lung faster than Pu. However, all aerosols studied can be considered to be relatively insoluble.

41570 (LMF—91, pp 28-31) **Models of disposition of inhaled ^{241}Am compounds.** Mewhinney, J.A.; Griffith, W.C. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

A surface area model for assessment of human inhalation exposures involving ^{241}Am has been developed. It is based on data from studies in which Beagle dogs inhaled monodisperse or polydisperse aerosols of $^{241}AmO_2$. Comparison of this model and the ICRP 30 model indicates that they differ in the rates at which absorption occurs from the nasopharyngeal, tracheobronchial and pulmonary regions of the respiratory tract. This model provides more realistic predictions for retention of ^{241}Am in the respiratory tract and uptake and retention in skeleton and liver, especially at early times after exposure.

41571 (LMF—91, pp 32-36) **Model for estimating body burdens of ^{241}Am from excretion analyses.** Griffith, W.C.; Mewhinney, J.A.; Muggenburg, B.A.; Boecker, B.B.; Cuddihy, R.G. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

A simple model for predicting the organ burdens of ^{241}Am from excretion rates is presented for inhalation exposures. The model uses three compartments representing lung, liver and skeleton. The model was developed using data from studies in laboratory animals of inhaled or injected ^{241}Am and was validated for humans by comparison to cases of accidental inhalation exposures of pure compounds of ^{241}Am. The model is shown to provide an adequate description for humans for up to 15 years after exposure. Presently available data for humans do not provide a single value for liver retention of ^{241}Am.

41572 (LMF—91, pp 37-39) **Early disposition of ^{244}CmO/sub x/ inhaled by rats.** Guilmette, R.A.; Kanapilly, G.M.; Lundgren, D.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Fischer-344 rats were given single inhalation exposures to monodisperse aerosols of ^{244}Cm oxide having activity median aerodynamic diameters (AMAD) of 0.70, 1.3 or 2.6 μm and heat monodisperse treated at 1150°C. The distribution of curium in rat tissues at 32 days showed 58 to 75% in lung, 5 to 12% in liver and 7 to 18% in skeleton. This distribution pattern was significantly different from those shown in previous studies using Cm oxide aerosols.

41573 (LMF—91, pp 40-45) **Radiation dose patterns in Beagle dogs following inhalation of monodisperse or polydisperse aerosols of $^{238}PuO_2$. VI.** Mewhinney, J.A.; Diel, J.H.; Muggenburg, B.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Beagle dogs received inhalation exposures to one of three sizes of monodisperse or a polydisperse aerosol of $^{238}PuO_2$. Periodic sacrifices and excreta collections provided data on the retention, translocation and excretion of ^{238}Pu. A mechanistic simulation model was formulated to account for particle dissolution and fragmentation. This model provided adequate representation of lung retention, uptake and retention in other organs, and excretion. The mechanistic model provided estimates of cumulative radiation dose to liver and bone that are a factor of five greater and to lung that are a factor of two less than estimated using the Task Group Lung Model.

41574 (LMF—91, pp 46-48) **Retention, distribution and dosimetry of inhaled $^{239}PuO_2$ particles in Beagle dogs. III. The effects of inhaled burden on retention.** Guilmette, R.A.; Diel, J.H.; Mewhinney, J.A.; Muggenburg, B.A.; Boecker, B.B. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The temporal pattern of radiation dose to tissues of Beagle dogs which have inhaled $^{239}PuO_2$ aerosols is being studied. Dogs received single inhalation exposures to monodisperse or polydisperse aerosols and are being sacrificed from four hours to eight years after exposure. The lung retention of Pu for dogs from the dose response study which have died from radiation pneumonitis and pulmonary fibrosis is greater than that of the corresponding sacrificed dogs. The role of radiation dose in altering lung retention of particulate Pu at low doses is being studied in a separate study.

41575 (LMF—91, pp 49-52) **Intrapulmonary distribution of $^{239}PuO_2$ particles inhaled by Beagle dogs.** Diel, J.H.; Guilmette, R.A.; Mewhinney, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Beagle dogs were exposed by inhalation to a monodisperse aerosol of 2.8 μm aerodynamic diameter $^{239}PuO_2$. The distribution of particles was studied at 8, 64, 128 and 365 days after inhalation exposure. The particles were relatively clumped at most times after exposure. Particles were deposited preferentially in the central regions of the lung and moved toward the periphery during the time studied.

41576 (LMF—91, pp 61-66) **Toxicity studies of inhaled beta-emitting radionuclides: status report.** Hahn, F.F.; McClellan, R.O.; Boecker, B.B. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The influence of total dose and dose rate on the effects of inhaled beta-emitting radionuclides is being studied in laboratory animals. The radionuclides are inhaled either in a relatively soluble form ($^{90}SrCl_2$, $^{144}CeCl_3$, $^{91}YCl_3$ or $^{137}CsCl$) or in a relatively insoluble form in fused aluminosilicate particles. The organs affected depend on the solubility and chemical characteristics of the radio isotopes. Studies with young adult dogs are complemented with comparable studies in other species (mice, rats and Syrian hamsters), with animals of different ages and with animals repeatedly exposed to ^{144}Ce.

41577 (LMF—91, pp 67-72) **Toxicity of inhaled $^{90}SrCl_2$ in Beagle dogs. XV.** Snipes, M.B.; Muggenburg, B.A.; Hahn, F.F.; Boecker, B.B.; Jones, R.K. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Beagle dogs were exposed to aerosols containing $^{90}SrCl_2$ to obtain initial body burdens ranging from 2.5 to 250 μCi ^{90}Sr/kg body weight. These dogs were maintained for lifetime observation or assigned to a sacrifice schedule. Dogs have died from a variety of causes related to radiation exposure, including bone marrow aplasia and bone-related neoplasms. During the past few years, most deaths have been due to conditions associated with aging, such as renal insufficiency and a variety of tumors in organs receiving low doses of radiation relative to the skeleton, which is the primary target of radiation exposure for internally deposited ^{90}Sr. The one exposed and one control dog remaining in this study will be observed for the remainder of their life spans.

41578 (LMF—91, pp 73-78) **Toxicity of inhaled $^{91}YCl_3$ in Beagle dogs. XV.** Hahn, F.F.; Muggenburg, B.A.; Boecker, B.B.; Jones, R.K.; Kusewitt, D.F.; McClellan, R.O.; Pickrell, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The metabolism, dosimetry and biological effects of inhaled $^{91}YCl_3$ in Beagle dogs are being studied. Forty-two dogs with initial ^{91}Y body burdens from 14 to 1300 μCi per kilogram body weight and 12 control dogs are being maintained for lifetime observation. Four additional dogs with a mean initial body burden of 180 μCi per kilogram body weight were placed in a sacrifice study. Forty-three of the exposed dogs and 11 of the control dogs have died. Dogs with the highest initial body burdens died with bone marrow damage and pancytopenia. Three dogs died with nasal cavity carcinomas, three dogs died with pulmonary carcinomas and one dog died with hepatic hemangiosarcoma; these cancers all appeared to be related to radiation injury. Control dogs died of miscellaneous neoplastic and chronic diseases. Observations are continuing on three surviving exposed dogs and one surviving unexposed dog.

41579 (LMF—91, pp 84-89) **Toxicity of injected $^{137}CsCl$ in Beagle dogs. XIV.** Muggenburg, B.A.; Hahn, F.F.; Boecker, B.B.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A.; Redman, H.C. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Studies of the metabolism, dosimetry and effects of intravenously administered $^{137}CsCl$ in the Beagle dog are being conducted to aid in assessing the biologic consequences of exposure to ^{137}Cs that might occur in the event of certain nuclear accidents. Effects of the chronic, relatively uniform whole-body exposures produced by ^{137}Cs are being compared with other diverse radiation dose patterns resulting from inhalation of radioactive aerosols. Forty-three of the dogs that were injected with $^{137}CsCl$ have died and five control dogs have died; nine exposed dogs died during the past year. Serial observations are continuing on the surviving 11 $^{137}CsCl$-injected dogs and seven control dogs.

41580 (LMF—91, pp 90-95) **Toxicity of ^{90}Y in a relatively insoluble form inhaled by Beagle dogs. XIII.** Hahn, F.F.; Hobbs, C.H.; Kusewitt, D.F.; McClellan, R.O.; Mauderly, J.L.; Pickrell, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The metabolism, dosimetry and biological effects of inhaled ^{90}Y in fused aluminosilicate particles in Beagle dogs are being studied. Eighty-nine dogs with initial lung burdens ranging from 80 to 5200 μCi ^{90}Y/kg body weight and 12 control dogs are being maintained for life span observations. The lung burdens achieved, short physical half-life and relative insolubility of the ^{90}Y in this vector resulted in a relatively high, rapidly decreasing radiation dose rate to the lung. To date, 60 exposed dogs have died; 38 from radiation pneumonitis, seven with pulmonary neoplasms and 15 from other causes. Two control dogs have died. Twenty-nine surviving exposed and 10 control dogs are being studied for their life spans.

41581 (LMF—91, pp 96-100) **Toxicity of ^{91}Y inhaled in a relatively insoluble form by Beagle dogs. XII.** Hahn, F.F.; Muggenburg, B.A.; Kusewitt, D.F.; Hobbs, C.H.; McClellan, R.O.; Mauderly, J.L.; Pickrell, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Beagle dogs were exposed to aerosols of ^{91}Y in fused aluminosilicate particles resulting in initial lung burdens ranging from 11 to 300 μCi ^{91}Y per kilogram body weight. These dogs were maintained for life span observation or assigned to a sacrifice schedule for study of radiation dose patterns. Dogs with higher lung burdens died at early times with radiation pneumonitis. At later times, tumors were seen in organs receiving high radiation doses; lung, nasal cavity, heart and tracheobronchial lymph nodes. Observations are continuing on the 26 exposed and 10 control dogs that remain alive 10 to 11.5 years after exposure.

41582 (LMF—91, pp 101-108) **Toxicity of ^{144}Ce inhaled in a relatively insoluble form by Beagle dogs. XIV.** Boecker, B.B.; Hahn, F.F.; Muggenburg, B.A.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The metabolism, dosimetry and effects of ^{144}Ce inhaled in fused aluminosilicate particles are being investigated using Beagle dogs to assess the long-term biological consequences of the release of relatively insoluble aerosol forms of ^{144}Ce that could occur in nuclear accidents. One hundred eleven dogs were exposed to aerosols of ^{144}Ce in fused aluminosilicate particles to yield initial lung burdens of 0.0024 to 210 μCi/kg body weight and 15 control dogs were exposed to nonradioactive fused aluminosilicate particles. To date, 73 ^{144}Ce-exposed and 4 control dogs have died or were euthanized at 143 to 4759 days after inhalation of ^{144}Ce. Observations are continuing on the 39 ^{144}Ce-exposed and 11 control dogs remaining alive at this time, at least 3702 days (~ 10 years) after exposure.

41583 (LMF—91, pp 109-112) **Toxicity of ^{144}Ce inhaled in a relatively insoluble form by immature Beagle dogs. X.** Boecker, B.B.; Muggenburg, B.A.; Hahn, F.F.; Mauderly, J.L.; McClellan, R.O. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Immature Beagle dogs (3 months of age) were exposed once by inhalation to an aerosol of ^{144}Ce incorporated in fused aluminosilicate particles to study the effects of age on the dose-response relationships for ^{144}Ce inhaled in a relatively insoluble form. Forty-nine dogs that received graded initial lung burdens ranging from 0.0004 to 140 μCi ^{144}Ce/kg body weight and five control dogs comprise this study. To date, 17 of the ^{144}Ce-exposed dogs and one of the controls have died. Dogs with the highest initial lung burdens of ^{144}Ce died first (during the first 4 months) with radiation pneumonitis, pulmonary fibrosis and congestive heart failure. Pulmonary hemangiosarcoma was the primary finding in dogs that died at 1.5 to 2 years after exposure. Deaths beyond that time have been due primarily to extrapulmonary hemangiosarcomas. Observations are continuing on the surviving 32 ^{144}Ce-exposed and four control dogs at 5.0 to 9.2 years after exposure.

41584 (LMF—91, pp 113-116) **Toxicity of ^{144}Ce inhaled in a relatively insoluble form by aged Beagle dogs. X.** Boecker, B.B.; Hahn, F.F.; Muggenburg, B.A.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The toxicity of relatively insoluble ^{144}Ce inhaled by 8- to 10.5-year old Beagle dogs is being investigated to provide possible age-related differences in long-term biological responses. Forty-two dogs were exposed, nose-only, to aerosols of ^{144}Ce in fused aluminosilicate particles to yield initial lung burdens of 2.2 to 75 μCi ^{144}Ce/kg body weight, and 12 control dogs were exposed to nonradioactive fused aluminosilicate particles. To date, 39 ^{144}Ce-exposed dogs and 10 control dogs have died or were euthanized between 197 and 2375 days after the inhalation exposure. Prominent findings in the ^{144}Ce-exposed dogs were radiation pneumonitis in 19 of the 23 dogs that died during the first 943 days after exposure and neoplastic disease in nine of the 16 dogs that died beyond 943 days after exposure. Pulmonary tumors were found in four of these dogs. Observations are continuing on the three surviving ^{144}Ce-exposed and two control dogs.

41585 (LMF—91, pp 117-121) **Toxicity of ^{90}Sr inhaled in a relatively insoluble form by Beagle dogs. XII.** Snipes, M.B.; Hahn, F.F.; Muggenburg, B.A.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Beagle dogs were exposed by inhalation to ^{90}Sr in a relatively insoluble form to study long-term health effects. Lung burdens ranged from 0.12 to 96 μCi of ^{90}Sr per kilogram of body weight. High levels of exposure resulted in radiation pneumonitis and pulmonary fibrosis; lower level exposures caused long-term effects which included cancer of the lung, heart and tracheobronchial lymph nodes. Most of these tumors were hemangiosarcomas. Two control dogs and two exposed dogs died during the past year; both exposed dogs died with hemangiosarcomas, one control dog died with lung carcinoma and the other with mammary adenocarcinoma.

41586 (LMF—91, pp 122-125) **Spontaneous primary lung tumors in the Lovelace ITRI Beagle dog colony.** Hahn, F.F.; Griffith, W.C. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

This report reviews the incidence and types of primary lung tumors in 77 dogs that died in a population of 225 control dogs. The median life span was 13.7 years. Five primary lung tumors, all adenocarcinomas of the peripheral lung, have been found. Although the histologic patterns were similar, a single cell of origin could not be determined. The cumulative incidence of lung tumors was 4.7% at 16 years of age and was dominated by the 14% age-specific incidence at 15 to 16 years of age.

41587 (LMF—91, pp 126-129) **Liver tumors in Beagle dogs exposed by inhalation to $^{144}CeCl_3$.** Kusewitt, D.F.; Hahn, F.F.; Muggenburg, B.A.; Boecker, B.B. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Primary malignant hepatic neoplasms developed in 9 of 55 Beagle dogs (16 percent) exposed to $^{144}CeCl_3$ in CsCl aerosol (seven primary hepatic hemangiosarcomas, one hepatocellular carcinoma and one intrahepatic bile duct carcinoma). Cerium-144 was rapidly translocated from the lung to the liver and skeleton; the liver received the highest cumulative beta dose. The latent periods of hepatic hemangiosarcomas appeared to be dose-related; death from hepatic hemangiosarcoma occurred earlier in dogs which received higher beta doses.

41588 (LMF—91, pp 130-133) **Repeated inhalation exposure of rats to aerosols of $^{144}CeO_2$. V.** Lundgren, D.L.; Hahn, F.F.; McClellan, R.O. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The effects of protracted beta irradiation of the lungs of rats are being studied. Rats were exposed once or repeatedly to aerosols of $^{144}CeO_2$ to achieve or reestablish lung burdens of 0.04, 0.20, 1.0 or 5.0 μCi of ^{144}Ce. The incidence of primary lung tumors was more related to the cumulative dose to the lungs than to the dose rate. A comparison of the incidence of lung tumors in the rat with that in mice and Syrian hamsters is presented.

41589 (LMF—91, pp 134-137) **Biological effects of repeated inhalation exposure of Beagle dogs to relatively insoluble aerosols of ^{144}Ce. VIII.** Boecker, B.B.; Hahn, F.F.; Muggenburg, B.A.; McClellan, R.O.; Mauderly, J.L.; Pickrell, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Beagle dogs were exposed repeatedly to a relatively insoluble form of ^{144}Ce to study the deposition, retention and long-term biological effects for comparison with data from dogs that were exposed only once to a similar aerosol. Four groups of nine dogs each were exposed once every 8 weeks for 2 years (13 exposures). Exposure goals were: to increase the lung burden by 2.5 μCi ^{144}Ce/kg

body weight with each exposure; to reestablish lung burdens of 9 or 4.5 μCi ^{144}Ce/kg body weight and to expose controls to fused aluminosilicate particles containing nonradioactive Ce. To date, 22 exposed dogs and 2 control dogs have died or were euthanized. The most prevalent findings to date have been pulmonary carcinomas (8 dogs) and hemangiosarcomas in the tracheobronchial lymph nodes (4 dogs). Observations are continuing on the five surviving ^{144}Ce-exposed and 7 control dogs that are now at approximately 2560 days (7.8 years) after the first exposure.

41590 (LMF—91, pp 138-141) **Theoretical cytotoxicity models for combined exposure of cells to different radiations.** Scott, B.R. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Theoretical cytotoxicity models for predicting cell survival after sequential or simultaneous exposure of cells to high and low linear energy transfer (LET) radiation are discussed. Major findings are that (1) ordering of sequential exposures can influence the level of cell killing achieved; (2) synergism is unimportant at low doses; (3) effects at very low doses should be additive; (4) use of the conventional relative biological effectiveness approach for predicting combined effects of different radiations is unnecessary at very low doses and can lead to overestimation of risk at moderate and high doses.

41591 (LMF—91, pp 145-149) **Toxicity of inhaled alpha-emitting radionuclides. Status report.** Muggenburg, B.A.; Mewhinney, J.A.; Guilmette, R.A.; Hahn, F.F.; Boecker, B.B.; Mauderly, J.L.; Lundgren, D.L.; Hobbs, C.H.; McClellan, R.O. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

A series of interrelated dose-response studies in which Beagle dogs and rodents are being exposed to aerosols of transuranic alpha-emitting radionuclides is described. Monodisperse aerosols of oxides of ^{239}Pu, ^{238}Pu, ^{240}Am, ^{244}Cm and ^{242}Cm are used in studies to measure the relative importance of average organ dose, local dose around particles, specific activity, particle size and number of particles inhaled upon the development of biological effects. The elemental characteristics, chemical form, species of animal and age of the animal at the time of inhalation exposure are also being studied as they may also influence the toxicity of these radionuclides.

41592 (LMF—91, pp 150-158) **Toxicity of $^{238}PuO_2$ in Beagle dogs. A. Monodisperse 1.5 μm AMAD particles. B. Monodisperse 3.0 μm AMAD particles. VIII.** Mewhinney, J.A.; Hahn, F.F.; Boecker, B.B.; Diel, J.H.; McClellan, R.O.; Mauderly, J.L.; Muggenburg, B.A.; Pickrell, J.A.; Guilmette, R.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Beagle dogs have received an inhalation exposure to one of two sizes of monodisperse aerosols of $^{238}PuO_2$ to achieve graded levels of initial lung burden. All dogs are being studied over their life span. Seventy-six dogs have died with initial lung burdens ranging from 0.02 to 1.5 μCi ^{238}Pu per kilogram body weight; eight died with radiation pneumonitis and pulmonary fibrosis, four died with lung tumors, 56 died with bone tumors, one died with a liver tumor and 7 died due to miscellaneous causes. Three control dogs have died. Sixty-eight exposed and 21 control dogs are surviving at 2021 to 2849 days after inhalation exposure.

41593 (LMF—91, pp 159-166) **Toxicity of inhaled $^{239}PuO_2$ in Beagle dogs. A. Monodisperse 0.75 μm AD particles. B. Monodisperse 1.5 μm AD particles. C. Monodisperse 3.0 μm AD particles. V.** Muggenburg, B.A.; Guilmette, R.A.; Hahn, F.F.; Boecker, B.B.; McClellan, R.O.; Mauderly, J.L.; Pickrell, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Studies on the metabolism, dosimetry and biological effects of inhaled particles of $^{239}PuO_2$ in Beagle dogs are in progress. To obtain information on the relative importance of homogeneity versus nonhomogeneity of radiation doses to the lung, dogs have been exposed to monodisperse aerosols of $^{239}PuO_2$ of 0.75, 1.5 or 3.0 μm aerodynamic diameter (AD). The exposures have resulted in graded initial lung burdens ranging from 0.0002 to 2.6 μCi ^{239}Pu per kilogram body weight. Other dogs were exposed to the aerosol diluent to serve as controls. Three dogs have died in the study with 0.75 μm AD particles, 34 dogs have died in the study with 1.5 μm AD particles and 30 dogs have died in the study with 3.0 μm AD particles of $^{239}PuO_2$. These dogs had radiation pneumonitis and pulmonary fibrosis at death. Seven dogs had incidental carcinomas of the lung. The remaining dogs have survived up to 1730 days after inhalation exposure and are being observed for the remainder of their life span.

41594 (LMF—91, pp 167-168) **Toxicity of $^{239}PuO_2$ in immature Beagle dogs. III.** Guilmette, R.A.; Muggenburg, B.A.; Hahn, F.F.; Mauderly, J.L.; Boecker, B.B.; McClellan, R.O. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Immature Beagle dogs have been exposed by inhalation to a monodisperse aerosol of $^{239}PuO_2$ (1.5 μm AD) to compare the biological effects with those seen in young adult and aged dogs exposed to a similar aerosol. To date 45 dogs have been exposed to the aerosol, resulting in graded lung burdens from 0.0031 to 0.64 μCi/kg body weight. Six dogs exposed to the dilute ammonium hydroxide aerosol only serve as controls. One experimental dog has died of parvovirus enteritis. Exposures will continue during the coming year to complete the experimental design.

41595 (LMF—91, pp 169-173) **Toxicity of inhaled $^{239}PuO_2$ in aged Beagle dogs. III.** Muggenburg, B.A.; Hahn, F.F.; Guilmette, R.A.; Boecker, B.B.; McClellan, R.O. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Studies to determine the effects of age at exposure on metabolism, dosimetry and biological effects of inhaled particles of $^{239}PuO_2$ are in progress in aged Beagle dogs (8.0 to 10.5 years of age at exposure). The dogs have inhaled particles of $^{239}PuO_2$ with activity median aerodynamic diameter of 1.5 μm to achieve initial lung burdens ranging from 0.02 to 0.66 μCi ^{239}Pu per kg body weight. Dogs exposed to the aerosol diluent serve as controls. Eight dogs died during the year. The 19 surviving exposed dogs and the 8 controls are being observed. There are three blocks (5 dogs per block) of male dogs planned for exposure in the next 12 months.

41596 (LMF—91, pp 174-177) **Repeated inhalation exposure of Beagle dogs to aerosols of $^{239}PuO_2$. V.** Diel, J.H.; Hahn, F.F.; Guilmette, R.A.; Lundgren, D.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Dogs were exposed once or repeatedly by inhalation to aerosols of $^{239}PuO_2$ to study the relative doses and effects of these two types of exposures. All dogs still alive in this study have been exposed eight times and maintained at least 3.7 years after their first exposure. Clearance of inhaled $^{239}PuO_2$ from repeated exposures is similar to that for single inhalation exposures. During the past year, one dog with a radiation dose to lung of 1960 rad was euthanized at 1267 days after first exposure with radiation pneumonitis.

41597 (LMF—91, pp 178-180) **Toxicity of inhaled $^{239}PuO_2$ in Fischer-344 rats. III.** Redman, H.C.; Griffith, W.C.; Guilmette, R.A.; Mewhinney, J.A.; Scott, B.R.; Muggenburg, B.A.; Boecker, B.B. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Studies on the biological effects of inhaled particles of $^{239}PuO_2$ in Fischer-344 rats are in progress. Information is being obtained on the importance of homogeneity or nonhomogeneity of radiation dose to the lung. The effects of age at exposure are also being evaluated on both young adult (84 days) and aged (630 days) animals. Young adult animals were exposed by inhalation to monodisperse aerosols of 1.0 or 2.85 μm aerodynamic diameter (AD)

$^{239}PuO_2$. The aged animals were exposed to 1.0 μm AD particles of $^{239}PuO_2$.

41598 (LMF—91, pp 181-185) **Inhalation exposure of rats to PuO_2 and NO_2.** Eidson, A.F.; Henderson, R.F.; Hahn, F.F. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

An experiment was conducted to investigate possible effects of NO_2 exposure on PuO_2 retention in laboratory rats and to investigate any combined biological effects of these toxicants on the lung by measuring biochemical indicators of lung damage. One group of animals was exposed to PuO_2 followed by NO_2 exposure. A second group of animals was exposed to NO_2 followed by PuO_2 exposure. Groups of animals exposed to NO_2 or PuO_2 alone served as control populations. Initial lung burdens of PuO_2 were 80 +- 60 nCi. Nitrogen dioxide exposures were at 20 parts per million over a 24-hour period. The results showed that the order of PuO_2 and NO_2 exposure did not affect PuO_2 clearance rates. There appeared to be differences in PuO_2 clearance at later times between the groups that inhaled PuO_2 only and the groups that also inhaled NO_2. However, the accumulated alpha radiation dose would be similar for all groups during the first 90 days. The results of biochemical tests indicative of damage to lung tissues showed that NO_2 exposure damaged lung tissues as expected but there was no synergism between NO_2 and PuO_2 apparent for early times after exposure.

41599 (LMF—91, pp 186-189) **Toxic effects of inhaled ^{244}CmO/sub x/ in rats.** I. Lundgren, D.L.; Hahn, F.F.; Guilmette, R.A.; Kanapilly, G.M. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The toxicity of ^{244}CmO/sub x/ is being studied in rats exposed by inhalation to monodisperse aerosols to achieve desired initial lung burdens of 2, 6, 17, 45, 150 and 450 nCi of ^{244}Cm. Curium-243 is being used to label the ^{244}CmO/sub x/ so that initial lung burdens of each rat can be determined. A total of 972 exposed rats and 158 sham exposed control rats are being held for life span observation. Preliminary data indicated that ≈ 85% of the initial body burden was cleared with a half-time of ≈ 1.5 days and the remaining ≈ 15% was cleared with a half-time of ≈ 65 days.

41600 (LMF—91, pp 190-193) **Relative effectiveness of ^{144}Ce and ^{239}Pu citrate in producing chromosome aberrations and cancer in the liver of Chinese hamsters.** Brooks, A.L.; Griffith, W.C.; McClellan, R.O.; Hahn, F.F.; Benjamin, S.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Chinese hamsters received intravenous or intraperitoneal injections of ^{239}Pu or ^{144}Ce citrate, respectively. Animals were either serially sacrificed following partial hepatectomy and the frequency of chromosome aberrations determined or were observed for 700 days and liver tumor frequency determined. The slopes of the dose response curves for chromosome aberrations was 3.1×10^{-2} and 4.7×10^{-1} aberrations/cell/Gy for ^{144}Ce-^{144}Pr and ^{239}Pu, respectively. The slope of the aberration response curve was independent of time and dose rate through 360 days. Plutonium was about 15 times as effective as ^{144}Ce in producing aberrations. At 700 days, ^{144}Ce and ^{239}Pu had induced liver tumors in 13% and 39% of the animals with an average dose of 65 or 14 Gy, respectively. The tumor incidence at 700 days was 2×10^{-3} and 3×10^{-2} tumors/animal/Gy for ^{144}Ce-^{144}Pr and ^{239}Pu, respectively. An effectiveness factor of 15 was derived for the induction of liver tumors in the Chinese hamster by ^{239}Pu.

41601 (LMF—91, pp 194-197) **Distribution and retention of ^{239}Pu and cytogenetic damage in Cynomolgus monkeys after inhalation of $^{239}Pu(NO_3)_4$.** Brooks, A.L.; Mewhinney, J.A.; Smith, J.A.; Redman, H.C.; McClellan, R.O. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Immature and mature Cynomolgus monkeys were exposed by inhalation of polydisperse aerosols of $^{239}Pu(NO_3)_4$. The initial lung burdens (ILB) of 1.0, 0.3 or 0.1 μCi were retained with an effective half-life of about 150 days. The decrease in lung burden was accompanied by an increase in ^{239}Pu in liver and bone. The liver-to-bone ratio of ^{239}Pu content ranged from 0.5 to 3.0. The ratio was lower in the immature than in the mature monkeys. The ^{239}Pu activity was deposited on bone surfaces. A more uniform surface distribution was seen in the immature than mature monkeys. The amount of ^{239}Pu in the testes of monkeys with 1.0 μCi ILB increased as a function of time to reach 0.6 nCi at 365 days after inhalation exposure. Chromosome aberration frequency in the blood lymphocytes was elevated at 6 months in the monkeys with 1.0 μCi ILB, but returned to the control level by one year after exposure. Chromosome aberration frequency was not a sensitive indicator of dose for internally-deposited ^{239}Pu in Cynomolgus monkeys.

41602 (LMF—91, pp 284-287) **Deposition and retention of ^{67}Ga-labelled diesel particles in Fischer-344 rats.** Wolff, R.K.; Sun, J.D.; Lopez, J.A.; Wolf, I.; Cheng, Y.S.; McClellan, R.O. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Fischer-344 rats were exposed nose-only to ^{67}Ga radiolabeled diesel exhaust particles produced from a 1 cylinder engine and diluted 10:1 with filtered air. Volume median diameters of the particles were 0.14 to 0.16 μm measured using an electrical aerosol analyzer, a diffusion battery and a cascade impactor. Initial lung deposition was 7 +- 2% and 12 +- 2% in two separate experiments. Gallium-67 left the lung rapidly with a clearance half-time of about 10 days, indicating that the ^{67}Ga label dissociated from diesel particles.

41603 (LMF—91, pp 288-292) **Lung deposition and retention of inhaled benzo(a)pyrene or nitropyrene adsorbed onto Ga_2O_3 particles and as pure aerosols.** Sun, J.D.; Wolff, R.K.; Kanapilly, G.M.; Aberman, H.M. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Various atmospheric chemical pollutants have been found on ultrafine particles. In this study, Fischer-344 rats were exposed by nose-only inhalation to ^{3}H-benzo(a)pyrene (^{3}H-BaP) or ^{3}H-nitropyrene (^{3}H-NP) adsorbed onto insoluble Ga_2O_3 particles or as pure aerosols. Association of BaP with these ultrafine particles increased lung retention of this polycyclic aromatic hydrocarbon, whereas similar differences were not seen with the ^{3}H-NP aerosols. Excretion of the radioactivity from inhaled pure ^{3}H-NP aerosols was primarily found in urine, whereas inhalation of the ^{3}H-NP-Ga_2O_3 and both ^{3}H-BaP aerosols resulted in the majority of the ^{3}H-radioactivity excreted in feces. These studies indicate that particle association of chemicals alters the ultimate biological fate of those chemicals as compared to the inhalation of pure compound. However, these alterations may not be uniform for every chemical. These observations may have significant implications in evaluating the health risks of human exposure to airborne chemical pollutants.

41604 **(PB—81-184566) CSU-FDA collaborative radiological health laboratory annual report 1979.** Benjamin, S.A. (Colorado State Univ., Fort Collins (USA). Coll. of Veterinary Medicine and Biomedical Sciences). Jan 1981. 178p. NTIS PC A09/MF A01.

The Collaborative Radiological Health Laboratory was established in 1962 by the Division of Biological Effects, Bureau of Radiological Health, and the Department of Radiology and Radiation Biology, Colorado State University, to assess possible long-term effects in the beagle from low-level whole-body gamma irradiation. The first section of this annual report summarizes the current status of the long-term effects of irradiation during development in the beagle. The second section addresses studies of radiation-induced and spontaneous disease in the beagle. Cardiovascular disease has also been noted to be a significant clinical disease problem in the aging beagle. The third section describes the CRHL data processing system as it existed and the current changes being made. Several aspects of the methods and procedures available for statistical analysis of data are discussed.

41605 **(PB—81-197881) Criteria for adequate radiation control programs (x ray): a report of Task Force 2A. Final report.** (Conference of Radiation Control Program Directors, Inc. (USA)). Apr 1981. 20p. NTIS, PC A02/MF A01.

This guide has been developed by the Task Force on Criteria for Adequate Radiation Control Programs (X Ray) at the direction of the Conference of Radiation Control Program Directors. The role of the radiation control program has changed over the years and recently there has been concern raised in the press and in Congress regarding the adequacy of the control of radiation in the United States. In general, these reports have been critical of the programs but there has been very little discussion of the reasons for the problems. Since adequate resources are fundamental to the successful implementation of any program, there needs to be an outline of what should be expected of radiation control programs and the resources needed to properly handle the problems. This document presents the guidance of the Task Force as a result of its research and deliberations. It presents, for the first time, a method for determining the quality and quantity of the human resources necessary for the successful operation of a balanced, thorough and yet efficient x-ray control program at the State level. This report should serve as the basis by which State radiation control agencies, legislative bodies, as well as the public can make realistic evaluations regarding the adequacy of x-ray control programs.

41606 **(UCRL—53205) Effect of low ^{60}Co dose rates on sister chromatid exchange incidence in the benthic worm, Neanthes arenaceodentata.** Harrison, F.L.; Rice, D.W. Jr. (Lawrence Livermore National Lab., CA (USA)). 13 Oct 1981. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01. Order Number DE82009840.

The usefulness of sister chromatid exchange (SCE) induction as a measure of low-level radiation effect was examined in a benthic marine worm, Neanthes arenaceodentata. Larvae were exposed to ^{60}Co radiation for 12 to 24 h at total doses ranging from 0.5 to 309 R and at dose rates from 0.04 to 13 R/h. Animals exposed at intermediate dose rates (0.5, 0.6, 1.25, 2.0, and 2.5 R/h) had SCE frequencies per chromosome about twice that of those receiving no radiation (controls), whereas those exposed at the higher dose rates (7.0 and 13 R/h) had SCE frequencies lower than the controls. Animals exposed at the lower dose rates (0.04 and 0.1 R/h) had lower SCE frequencies than those exposed at intermediate dose rates (and higher SCE frequencies than controls). The length of chromosome pair number one differed among metaphase spreads and was used as an index of chromosome condensation in a given metaphase. Because there is a possibility that chromosome morphology may affect the ability to resolve SCEs, morphology will be monitored in future studies. A preliminary experiment was performed to assess the effects of 2.2 and 11.5 R/h for 24 h on growth and development. Larvae observed at 6 and 17 d after irradiation did not have significantly different numbers of abnormal larvae or survival rates.

41607 **Effect of changes in cell geometry associated with freezing on the radiation dose from decay of internal isotopes.** Commerford, S.L.; Cronkite, E.P. (Brookhaven National Lab., Upton, NY (USA)); Reincke, U. (Harvard Medical School, Boston, MA (USA)). *International Journal of Radiation Biology and Related Studies in Physics, Chemistry and Medicine;* **41**: No. 1, 99-103(Jan 1982).

Measurements of the resistance to radiation damage accumulated while frozen by murine haematopoietic stem cells equilibrated with tritiated water and glycerol before freezing indicate that about 90 per cent of the cell water and 60 per cent of the cell mass is lost during freezing. Presumably this is due to the increase in osmotic pressure in the extracellular liquid which results from ice formation. Consequently, it is suggested that the radiation dose to frozen cells from internal isotopes should be calculated on the basis of cell and nuclear volumes about half as large as the unfrozen volumes.

41608 **Correlation between inactivation of human cells and numbers of pyrimidine dimers induced by a sun lamp and 254 nm radiation.** Kantor, G.J.; Setlow, R.B. (Brookhaven National Lab., Upton, NY). *Photochemistry and Photobiology;* **35**: 269-274(1982).

Nondividing human fibroblasts are inactivated by radiation from a source (a Westinghouse sun lamp) that stimulates the UV spectrum of sunlight. Survival curves determined for a DNA excision repair-proficient and a repair-deficient strain (XP12BE) are related to those determined using germicidal light (254 nm) by constant fluence modification factors. In addition, the same fraction of XP12BE cells are killed per pyrimidine dimer by 254 nm and sun lamp light. These results, when related to other survival and photoreactivation studies, suggest that the mechanism for inactivation of nondividing human cells by sun lamp light is the same as that by 254 nm and that pyrimidine dimers are the major responsible photolesion. Repair reverses some of the lethal effects of this light. We suggest that these conclusions apply to sunlight-irradiated skin cells in vivo.

41609 **Clonal proliferation of cultured nonmalignant and malignant human breast epithelia.** Smith, H.S. (Peralta Cancer Research Inst., Oakland, CA); Lan, S.; Ceriani, R.; Hackett, A.J.; Stampfer, M.R. *Cancer Research;* **41**: 4637-4643(Nov 1981).

We have developed a method for clonal growth of human mammary epithelial cells of both nonmalignant and malignant origin. Plating efficiencies of 1 to 50% were obtained by seeding second-passage mammary epithelial cells on fibroblast feeder layers in an enriched medium composed of various hormones and growth factors, as well as conditioned media from three specific human cell lines. Single mammary epithelial cells seeded sparsely onto the fibroblasts underwent at least eight population doublings to form large, readily visible colonies. Optimal colony formation required both feeder cells and the enriched medium. Epithelial colonies containing at least 16 cells were visible 5 days postseeding, and these colonies continued to grow progressively. Plating efficiency and colony size were similar on ultraviolet-irradiated or nonirradiated fibroblasts. The number of colonies formed was proportional to the number of epithelial cells plated. The colonies were identified as epithelial by the presence of human mammary epithelial antigens.

41610 **Absorption, transport, and chemical fate of plutonium in soybean plants.** Garland, T.R.; Cataldo, D.A.; Wildung, R.E. (Pacific Northwest Lab., Richland, WA). *Journal of Agricultural and Food Chemistry;* **29**: 915-920(Sep 1981). Contract AC06-76RLO1830.

Absorption of plutonium (Pu) by soybean plants (Glycine max cv. Williams) is limited by Pu solubility in soils. Changes in Pu concentration in different tissues with time to senescence indicate Pu is freely transported through the xylem during growth but not subject to remobilization on flowering. Studies in which the DTPA complex of ^{238}Pu was supplied to the plant suggest a change in chemical form following root absorption. Of the Pu in roots, stems, and leaves at senescence, 28, 54, and 67%, respectively, were soluble. The Pu in the solluble fraction was primarily associated with components of >10000 equivalent molecular weight in leaves and roots, whereas stems exhibited an equal distribution between components in the >10000 and <500 molecular weight fractions. Plutonium associated with mature seeds is concentrated in the seed hull (85%) and cotyledons (14%). The Pu associated with the cotyledon was primarily in the insoluble residues and soluble soy whey.

41611 **Aphidicolin inhibits repair of DNA in UV-irradiated human fibroblasts.** Snyder, R.D. (Univ. of Tennessee, Oak Ridge); Regan, J.D. *Biochemical and Biophysical Research Communications;* **99**: No. 4, 1088-1094(30 Apr 1981). Contract W-7405-ENG-26.

Aphidicolin, a specific inhibitor of DNA polymerase α, is shown to inhibit DNA repair in human diploid fibroblasts. Although aphidicolin has no apparent effect on the DNA of unirradiated cells, it causes a large number of strand breaks to accumulate in UV-irradiated cellular DNA. The number of breaks is the same as the number observed following a similar dose of ultraviolet light when cells are treated with arabinofuranosyl cytosine (araC) and hydroxyurea (HU), known inhibitors of repair. Moreover, two-dimensional paper chromatography shows that aphidicolin completely blocks removal of pyrimidine dimers. These observations are discussed in light of the proposed roles of DNA polymerases α and β in DNA replication and repair and the action of aphidicolin on polymerase α.

41612 Harman inhibits the removal of pyrimidine dimers from the DNA of human cells. Castellani, A.; Setlow, R.B. (Brookhaven National Lab., Upton, NY). *Biochemical and Biophysical Research Communications;* **98**: No. 3, 823-828(12 Feb 1981).

Normal human fibroblasts were UV-irradiated and incubated for 6 hr with harman. The losses of sites, in the extracted DNA, sensitive to a UV specific endonuclease were determined as precision measures of the excision of UV-induced pyrimidine dimers. Harman inhibited excision, rising from ~ 30% inhibition at 200 μM to 75% inhibition at 500 μM.

41613 Health and mortality of DOE workers. Beck, W.L.; Dupree, E.A.; Frome, E.L.; Fry, S.A.; Hansard, M.S.; Hudson, D.R.; Lushbaugh, C.C.; Polednak, A.P. (ORAU). *Transactions of the American Nuclear Society;* **38**: 81(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41614 Imprecision in predicted dose from sup 137 CS resulting from biological variability. Dunning, D.E. Jr; Schwarz, G. (ORNL). *Transactions of the American Nuclear Society;* **38**: 63-64(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41615 Health effects of low-level radiation. Auxier, J.A. (ORNL). *Transactions of the American Nuclear Society;* **38**: 83-84(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41616 Aspects of uncertainty analysis in accident consequence modeling. Hoffman, F.O.; Travis, C.C. (ORNL). *Transactions of the American Nuclear Society;* **38**: 91-92(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41617 A simplified evacuation model for estimating mitigation of early population exposures. Strenge, D.L. (PNL). *Transactions of the American Nuclear Society;* **38**: 95-96(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41618 The impact of risk considerations on dosimetry of radiopharmaceuticals. Eckerman, K.F. (ORNL). *Transactions of the American Nuclear Society;* **38**: 59-60(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41619 Radiosterilization of rat liver microsome containing postmitochondrial supernatant for mutation assays. Barfknecht, T.R.; Andon, B.M.; Bishop, W.W.; Thilly, W.G. (Massachusetts Inst. of Tech., Cambridge). *Environmental Mutagenesis;* **3**: 565-573(1981). Contract AC02-77EV04267.

Gamma-irradiation was effectively employed to sterilize rat liver postmitochondrial supernant (PMS), which is required for the metabolic activation of soots and soot-derived polycyclic aromatic hydrocarbons to mutagens. When a known number of Bacillus subtilis spores were added to the PMS and gamma-irradiated at -80°C, a 2-Mrad dose resulted in a 7.5 log kill of the spores. A dose of 3 Mrads was selected as a sufficient effective sterilizing dose and had no significant effect upon the ability of gamma-irradiated PMS to metabolically activate diesel soot and two diesel soot components, benzo(a)pyrene and fluoranthene to mutagens in a Salmonella typhimurium 8-azaguanine resistance forward mutation assay. Three Mrads of gamma-irradiation also had no effect upon the ability of PMS to activate benzo[a]pyrene to a mutagen for the human lymphoblasts. However, gamma-irradiation did reduce the ability of PMS to activate dimethylnitrosamine to a mutagen for S typhimurium.

41620 Near-ultraviolet mutation of transforming DNA irradiated in vivo. Cabrera-Juarez, E.; Setlow, J.K. (Brookhaven National Lab., Upton, NY). *Mutation Research;* **83**: 301-306(1981).

Our previous work has demonstrated that whereas near-UV radiation is not a mutagen for Haemophilus influenzae cells, it does induce mutations in purified transforming DNA. In order to test various hypotheses concerning this difference, we have irradiated cells at 334 and 335 nm, then lysed them and assayed the DNA for induced mutations and for inactivation of transforming ability. The inactivation was only a little lower than observed with highly purified transforming DNA. The DNA irradiated in vivo was mutated at both wave-lengths, but with considerably lower efficiency than was purified DNA. Neither incubation of the cells after irradiation and before lysis nor freezing and thawing the cells significantly changed the amount of mutation. It is concluded that there is some protection of the DNA against premutational lesions by the in vivo environment, but that it is not enough to account for the total lack of mutation of the cells. A probable explanation of this lack of cell mutation is that lethal lesions in the cells are induced much more readily than premutational lesions.

41621 Sensitivity of DNA repair-deficient strains of Escherichia coli K-12 to various furocoumarins and near-ultraviolet radiation. Grossweiner, L.I.; Smith, K.C. (Stanford Univ., CA). *Photochemistry and Photobiology;* **33**: 317-323(1981). Contract AS02-76EV02217.

Survival curves were obtained for DNA repair-deficient strains in Escherichia coli K-12 (polA1, uvrB5, and recA56) exposed to near-ultraviolet radiation [black light (BL)] in the presence of the DNA cross-linking agent 8-methoxypsoralen (8-MOP) or in the presence of photosensitizers forming primarily monoadducts with DNA [angelicin; 3-carbethoxypsoralen (3-CPs); 5,7-dimethoxycoumarin (DMC)], and after exposure to blue light (BluL) in the presence of 8-MOP or 3-CPs. An interpretation of these data suggests that DNA polymerase I is required for the major pathway of monoadduct repair, but appears to play little or no role in the repair of 8-MOP cross-links. The uvrB and recA strains were very sensitive, both to the cross-linking agent and to the monoadduct formers. The markedly different results for BL plus DMC or 3-CPs compared to angelicin suggests that the DMC and 3-CPs monoadducts are repaired by a different mechanism than are the angelicin monoadducts, or else DMC and 3-CPs undergo photochemical side reactions that produce DNA lesions other than the expected monoadducts. From photochemical evidence, we predicted that fewer 8-MOP monoadducts should be converted to cross-links by BluL vs BL; this appears to be the case. 3-CPs showed dramatically different biological results when irradiated with BL vs BluL, suggesting that 3-CPs may form more types of photoproducts than the expected monoadducts; BluL, however, appears to favor monoadduct formation.

41622 Classification of chemical agents as to their ability to induce long- or short-patch DNA repair in human cells. Francis, A.A. (Oak Ridge National Lab., TN); Snyder, R.D.; Dunn, W.C.; Regan, J.D. *Mutation Research;* **83**: 159-169(1981). Contract W-7405-ENG-26.

33 chemical agents and UV- and γ-irradiation were tested for their comparative ability to induce long-patch or short-patch repair using the 5-bromodeoxyuridine photolysis assay. For 11 chemical agents repair was long-patch in nature as determined by calculated patch size and response of xeroderma pigmentosum cells relative to normal human cells. Typical patch sizes as measured by this assay were about 90 nucleotides for UV repair, a range of 30 to 70 nucleotides for a variety of known and suspected UV-mimetic chemicals, and 304 nucleotides for γ-radiation. Alkylating agents previously shown to induce short-patch repair were shown also to induce long-patch repair.

41623 DNA repair in a UV-sensitive mutant of a mouse cell line. Sato, K.; Setlow, R.B. (Brookhaven National Lab., Upton). *Mutation Research;* **84**: 443-455(1981).

A UV-sensitive mutant, Q31, isolated from mouse-lymphoma L5178Y cells, was studied for excision and post-replication repairs. A nearly equal number of UV endonuclease-sensitive sites was in-

duced by UV in L5178Y, Q31, and human Raji cells. L5178Y cells irradiated with 10 J/m² removed 18% of sensitive sites from DNA during incubation of 24 h, and Q31 cells removed 3% of the sites, a fraction less than the limit of detection, whereas Raji cells eliminated about 60% of the sites. These results indicate that mouse-lymphoma cells are capable of excision repair to a limited extend as compared with human cells and that mutant Q31 cells are essentially devoid of dimer excision. The newly synthesized DNA was of smaller size in UV-irradiated and unirradiated Q31 cells than that in the corresponding L5178Y cells, but the DNAs in both cell strains increased to comparable sizes after a 2-h chase.

41624 Interaction of 8-methoxypsoralen and near-UV light causes mutation and cytotoxicity in mammalian cells. Schenley, R.L.; Hsie, A.W. (Oak Ridge National Lab., TN). *Photochemistry and Photobiology;* **33**: 179-185(1981). Contract W-7405-ENG-26.

The interaction of near-UV light and a photosensitizer, 8-methoxypsoralen (8-MOP), was studied in the Chinese hamster ovary cell/hypoxanthine-guanine phosphoribosyl transferase system; cell survival (cloning efficiency) and mutation induction (resistance to 6-thioguanine) were quantified. Exposure of cells to either 8-MOP up to 20 μg/ml (93 μM) or near-UV light up to 40000 J/m² had no effect on either survival or mutation frequency. Preincubation of cells with 8-MOP from 5 to 120 min prior to irradiation with various fluences did not affect cell survival or mutation frequency. Survival decreased and mutation frequency increased linearly when either the 8-MOP concentration or fluence was increased while the other factor was held as a constant. Mutation frequency appears to show reciprocity relative to the product of 8-MOP concentration times fluence of near-UV light [(μg/ml).(J/m²)] throughout a range apparently limited by high cell lethality. The observed pooled data on mutation, f(x), as a function of (μg/ml).(J/m²), x, fit a line dose-response line, $f(x) = (34.2 + 0.05x) \times 10^{-6}$. Cell survival, however, does not appear to exhibit such reciprocity.

41625 Serine-inserting UAA suppression mediated by yeast tRNA/sup Ser/. Ono, B.I. (Okayama Univ., Japan); Wills, N.; Stewart, J.W.; Gesteland, R.L.; Sherman, F. *Journal of Molecular Biology;* **150**: 361-373(1981). Contract AC02-76EV03490.

The number of loci that give rise to serine-inserting UAA suppressors in the yeast Saccharomyces cerevisiae was determined by examining over 100 of the revertants that suppressed the two UAA markers his4-1176 and leu2-1; the his4-1176 marker is suppressed by serine-insertng but not by tyrosine- or leucine-inserting suppressors and the leu2-1 marker is suppressed by all UAA suppressors. The suppressors could be assigned to one or other of the four loci: SUP16 and SUP17, which were previosly known to yield serine-inserting suppressors, and SUP19 and SUP22. The chromosomal map position of SUP19 suggested that it may be allelic to the previously reported suppressor SUP20, while the SUP22 suppressor has not been described. Representatives of all of the four suppressors were found to insert serine at the UAA site in iso-1-cytochrome c from supressed cyc1-72 strains. The degree of suppression by the serine-inserting suppressors was SUP16 > SUP17 > SUP19 > SUP22. The efficiency of suppression of each of the four serine suppressors was increased by the chromosomal mutation sal and by the cytoplasmic determinant Psi^+. Read-through of the synthetase gene of the RNA bacteriophage Qβ in a cell-free system was used to demonstrate that tRNA/sup Ser/ from SUP16, SUP17 and SUP19 strains can translate UAA codons. In contrast, tRNA/sup Ser/ or total tRNA from SUP22 strains had no suppressing activity. The results suggest that the three loci SUP16, SUP17 and SUP19 encode iso-accepting species of tRNA/sup Ser/, and that the UAA supression is mediated by mutationally altered tRNA molecules. The mechanism of SUP222 suppression remains unknown.

41626 Expression of embryonic hemoglobin genes in mice heterozygous for α-thalassemia or β-duplication traits and in mice heterozygous for both traits. Popp, R.A.; Marsh, C.L.; Skow, L.C. (Oak Ridge National Lab., TN). *Developmental Biology;* **85**: 123-128(1981). Contract W-7405-ENG-26.

Hemoglobins of mouse embryos at 11.5 through 16.5 days of gestation were separated by electrophoresis on cellulose acetate and quantitated by a scanning densitometer to study the effects of two radiation-induced mutations on the expression of embryonic hemoglobin genes in mice. Normal mice produce three kinds of embryonic hemoglobins. In heterozygous α-thalassemic embryos, expression of EI (x_2y_2) and EII (α_2y_2) is deficient because the x- and α-globin genes of one of the allelic pairs of Hba on chromosome 11 was deleted or otherwise inactivated by X irradiation. Simultaneous inactivation of the x- and α-globin genes indicates that these genes must be closely linked. Reduced x- and α-chain synthesis results in an excess of y chains that associate as homotetramers. This unique y_4 hemoglobin also appears in β-duplication embryos where excess y chains are produced by the presence of three rather than two functional alleles of y- and β-globin genes. In double heterozygotes, which have a single functional allele of x- and α-globin genes and three functional alleles of y- and β-globin genes, synthesis of α and non-α chains is severely imbalanced and half of the total hemoglobin is y_4. Mouse y_4 has a high affinity for oxygen, P_{50} of less than 10 mm Hg, but it lacks cooperativity so is inefficient for oxygen transport. The death of double heterozygotes in late fetal or neonatal life may be in large part to oxygen deprivation to the tissues.

41627 Photoreactivating enzyme activity in the rat tapeworm, Hymenolepis diminuta. Woodhead, A.D. (Brookhaven National Lab., Upton, NY); Achey, P.M. *Journal of Parasitology;* **67**: No. 3, 368-371(1981).

There has been considerable speculation about the occurrence of photoreactivating enzyme in different organisms and about its biologic purpose. We have developed a simple, sensitive assay for estimating pyrimidine dimers in DNA which is useful in making a rapid survey for the presence of the enzyme. Using this method, we have found photoreactivating enzyme activity in the tissues of the rat tapeworm, Hymenolepis diminuta. This parasite spends the majority of its life span in the bodies of its definitive or intermediate hosts, but a period is spent externally. We suggest that photoreactivating enzyme may be important in perserving the integrity of embryonic DNA during this free-living stage.

41628 X-ray-induced chromosome aberrations in Down lymphocytes: an explanation of their increased sensitivity. Preston, R.J. (Oak Ridge National Lab., TN). *Environmental Mutagenesis;* **3**: 85-89(1981). Contract W-7405-ENG-26.

Unstimulated lymphocytes from individuals with Down Syndrome (trisomy 21) are more sensitive to the induction of dicentric and ring aberrations by X rays than normal lymphocytes. Several explanations involving the more rapid rejoining of X-ray-induced lesions in Down cells have been offered. It is shown here that the repair of the DNA damage converted into chromosome aberrations is more rapid in Down cells than normal cells. This more rapid repair results in a higher probability of producing chromosome aberrations, and hence higher aberration frequencies in Down than normal cells.

41629 Somatosensory deficits in monkeys treated with misonidazole. Maurissen, J.P.J.; Conroy, P.J.; Passalacqua, W.; Von Burg, R.; Weiss, B.; Sutherland, R.M. (Univ. of Rochester, NY). *Toxicology and Applied Pharmacology;* **57**: 119-126(1981). Contract AC02-76EV03490.

Misonidazole, a hypoxic cell radiosensitizer, can produce peripheral sensory disorders in humans. It has been studied in monkeys with a computer-controlled system for evaluating vibration sensitivity. Monkeys were trained to report when vibration was stimulating the finger tip. Sinusoidal vibrations of several frequencies were presented. Two monkeys were dosed with misonidazole and their vibration sensitivity tested. They received a dose of 3 g/m² (about 180 mg/kg) twice weekly over a period of 6 to 10 weeks. An amplitude-frequency detection function was determined for each monkey before and after drug treatment. An analysis of covariance comparing polynomial regressions was performed. A significant difference ($p < 0.001$) was found between control and experimental curves in both monkeys. Pharmacokinetic data indicated a half-life of the drug in blood of about 4 to 5 hr. The overall half-life for elimination did not increase throughout prolonged treatment with msonidazole. Neither motor nor sensory nerve conduction velocity was reduced after treatment.

41630 Mortality of the harvester ant (Pogonomyrmex owyheei) after exposure to ^{137}Cs gamma radiation. Gano, K.A. (Pacific Northwest Lab., Richland, WA). *Environmental Entomology;* **10**: 39-44(1981). Contract AC06-76RLO1830.

Harvester ants, Pogonomyrmex owyheei Cole, irradiated with 3.5 kR to 268 kR of ^{137}Cs gamma radiation, were maintained at simulated summer (27°C) and winter (7°C) temperature regimes. After thirty days, the cool series was warmed to 27°C and observed for mortality along with the warm series.Though mortality was delayed in the cool series, each series reached 50% mortality at similar rates. Because the harvester ant is extremely tolerant to radiation and experimental rates used far exceed possible environmental exposure, it is unlikely that ant colonies dwelling among low-level nuclear waste storage sites will be deleteriously affected by radiation. This species has the capability of tunneling to a depth well within the range of some buried waste. Since these harvester ants are potential transporters of buried waste, they should be considered as a biotic factor in radioactive waste management operations in semi-arid regions.

41631 Dynamics of radionuclide exchange in the calcareous algae Halimeda at Enewetak Atoll. Spies, R.B. (Lawrence Livermore Lab., CA); Marsh, K.V.; Kercher, J.R. *Limnology and Oceanography;* **26**: No. 1, 74-85(1981). Contract W-7405-ENG-48.

Measurements of $^{239+240}Pu$ in the detrital inclusions and in acid-soluble and acid-insoluble fractions of Halimeda macrophysa showed a 10-fold higher concentration in the acid-insoluble coenocytic filaments than in the acid-soluble fraction. In a depuration experiment with Halimeda incrassata at Enewetak Atoll the loss rate of six radionuclides was measured. Data for ^{60}Co, ^{137}Cs, and ^{102}/sup m/Rh were fit to loss curves by using one term for exponential loss; data for ^{155}Eu, $^{239+240}Pu$, and ^{241}Am required two terms. For each radionuclide, compartment size and transfer functions were determined for the apropriate one- and two-compartment models. Of 26 possible two-compartment models, only seven gave solutions with our data. Nearly identical loss rates were obtained for ^{155}Eu, $^{239+240}Pu$, and ^{241}Am in the fast-exchanging compartments for all seven models. The uptake rates for these nuclides were also similar when uptake rates were normalized to local sediment concentrations. The fast-exchanging compartment probably corresponds to the mucilage surface layer of the coenocytic filaments. The identity of the slow-exchanging compartment is less certain but it may correspond to the skeletal surface.

41632 Synthetic enterobactin analogues. Carboxamido-2,3-dihydroxyterephthalate conjugates of spermine and spermidine. Weitl, F.L.; Raymond, K.N.; Durbin, P.W. (Lawrence Berkeley Lab., CA). *Journal of Medicinal Chemistry;* **24**: No. 2, 203-206(1981). Contract W-7405-ENG-48.

Two examples of a new class of synthetic polycatecholate ligands, the carboxamido-2,3-dihydroxyterephthalate conjugates of spermine (8) and of spermidine (10), have been synthesized via the generally useful synthon methyl-2,3-dimethoxyterephthaloyl chloride (6). Initial biological evaluation reveals tetrameric terephthalate (8) to be an extremely effective agent for sequestering and removing plutonium from mice; a single 25-μmol/kg (ip) dose of 8 removed 73% of the plutonium citrate previously injected (iv, 1 h earlier). Under the same conditions, trimeric terephthalate (10) excreted only 49% of injected plutonium. In vitro kinetic experiments have shown that 10 rapidly and quantitatively removed Fe from human transferrin. These results are discussed in relation to the design of metal-ion specific sequestering agents.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 40666, 41350, 41453

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 40131, 40193, 40193, 40194, 40197, 40201, 40948, 41190, 41410, 41411, 41412, 41487, 41503, 41542, 41602, 41603, 41622, 41632

41633 (AD-A—102678/0) Chemical characterization and toxicologic evaluation of airborne mixtures. Final report 1 October 79-30 July 1980. Ballou, J.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1981. 78p. NTIS, PC A05/MF A01.

Generators were constructed to produce both petroleum (SGF-2) and red phosphorus/butyl rubber (RP/BR) smoke aerosols. The petroleum smoke generator produced smoke concentrations of 2 to 10 mg/l for several hours with standard deviations less than 12%. Aerosol particles ranged in size from 0.6 to 1.6 micrometers MMAD with sigma sub g 1.5 to 1.9. Chemical composition of particles was not related to particle size. Using the Battelle-designed exposure chamber, male and female Sprague-Dawley rats were exposed to the petroleum aerosol at concentrations of 2.65 to 10.73 mg/l for periods of 1 to 6 hours. Animal deaths occurred only in the 6-hour exposure to 10.73 mg/l. One of the dead animals had serosanguineous nasal discharge and frothy tracheal contents. The RP/BR smoke generator produced smoke concentrations of 2 to 10 mg/l. Aerosol particles were on the order of 0.9 to 1.4 micrometers MMAD with sigma sub g 1.5 to 1.7. Rats were exposed to 3.15, 4.33, 5.36 and 8.46 mg/l for 1 hour and 1.53 mg/l for 4 hours. The 4.33 mg/l exposure produced 50% mortality. Of the 40 animals exposed for 1 hour, 23 died within 14 days. All of these died on days 1, 2, 6, 8, 9, 10, or 11, suggesting both acute and delayed causes of death. Grossly observed pathology, which consistently involved the laryngeal and proximal tracheal region, included marked erosion and edema of these areas.

41634 (CONF-820331—7) In vitro toxicity screening of dielectric gases using mammalian cells. Griffin, G.D.; Owen, B.A.; Easterly, C.E.; Walsh, P.J. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE82008805.

From 3. conference on gaseous dielectrics; Knoxville, TN, USA (7 Mar 1982).

The potential of various dielectric gases to cause cellular death was assayed in an in vitro cell culture system using Chinese hamster V79 (lung) cells. Exposures were carried out in small tubes which were constantly rotated, so that cells were exposed to the gas with only a thin layer of culture liquid interposed. Results indicated that SF_6 was essentially without cytotoxic effect, but after discharge of 16 kJ total spark energy in 60 cm^3 of SF_6, such samples of freshly sparked gas were quite cytotoxic (~ 60% and 90% cell death following 1 and 4 hr exposures, respectively. The toxicity of these sparked samples was observed within 15 min of exposure of the cells (~ 60% cell killing), and the degree of cell death increased with time of exposure, at least up to 2 hrs. The cytotoxicity of sparked SF_6 samples decreased with time of storage, so that after 4 wks, such samples were only minimally cytotoxic. Increasing spark energy produced samples with increased cytotoxic activity (1.6 kJ caused ~ 70% cell death after a 4 hr exposure, while 160 kJ of spark energy resulted in total cytotoxicity, after 1 hr).

41635 (CONF-8103119—1) Species heterogeneity in the metabolic processing of benzo(a)pyrene. Selkirk, J.K.; MacLeod, M.C.; Mansfield, B.K.; Nikbakht, P.A.; Dearstone, K.C. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 21p. NTIS, PC A02/MF A01. Order Number DE82008843.

From Symposium on organ and species specificity in chemical carcinogenesis; Raleigh, NC, USA (2 Mar 1981).

The drug metabolizing microsomal mixed-function oxidase (MFO) is a complex of enzymes required for the activation and detoxification of xenobiotics. Metabolism studies with many chemical carcinogens and mutagens in large numbers of different cell types and species and tissues have shown a remarkable qualitative similarity in the metabolic products formed by this enzyme complex. However, there is considerable variance from a quantitative aspect at several important levels in this biochemical process. Furthermore, within a given species, there can be major strain differences, not only in hepatic tissue, which is the major site for mixed function oxidase activity, but in all the organs and tissues throughout

the body. Since the MFO system is a complex of both activating and detoxifying enzymes, one may find variable levels of mixed function oxidase and the detoxification epoxide hydrase within a given activation system. This in turn may dictate whether there will be a high or low relative level of reactive electrophile available for interaction with critical target sites. Beno(a)pyrene (B[a]P), a major environmental carcinogen and mutagen, has been used as the paradigm for environmental chemical carcinogens. We have studied the metabolism of B(a)P in human and rodent cell lines to determine quantitative and qualitative variance between species.

41636 (LMF—91, pp 5-9) **Use of ^{85}Kr to determine specific surface areas of samples requiring glove box containment.** Rothenberg, S.J.; Eidson, A.F.; Newton, G.J.; Mewhinney, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

A comparison of surface area data obtained by gamma counting of adsorbed ^{85}Kr and by a classical microbalance technique is reported. Reproducibility, precision and self-consistency of the new ^{85}Kr method are discussed. Some preliminary surface area data for size-selected fused aluminosilicate particles are reported.

41637 (LMF—91, pp 220-224) **Mass spectrometry/mass spectrometry studies of nitro-PAHS in diesel soot extracts.** Henderson, T.R.; Sun, J.D.; Clark, C.R.; Dutcher, J.S. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Tandem triple quadrupole mass spectrometry (MS/MS) was used to compare the nitro-aromatic compounds in exhaust soot extracts from two different diesel engines operating on the same fuel. Dinitropyrenes were detected in single cylinder diesel exhaust, but not in Oldsmobile diesel exhaust. The other differences in the nitro-aromatic derivatives between the two exhaust samples were slight. Exhaust particulate extracts were similar to an aromatic fraction isolated from diesel fuel and treated with NO_2. Addition of pyrene to the single cylinder diesel fuel increased pyrene in exhaust extracts. Treatment of diesel soot extracts with NO_2 increased the mutagenic activity more than one thousandfold after pyrene addition to fuel. NO/sub x/ species may be a limiting factor in the formation of exhaust mutagenic activity.

41638 (LMF—91, pp 231-234) **Influence of driving cycle and operating temperature on the mutagenicity of diesel exhaust particle extracts.** Clark, C.R.; Dutcher, J.S.; Brooks, A.L.; Naman, T.M.; Seizinger, D.E. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Oldsmobile and Volkswagen diesel passenger cars were operated on a chassis dynamometer and the particulate portion of the exhaust was collected on high volume filters. Dichloromethane extracts of the exhaust particles (soot), collected while the cars were operated under simulated highway, urban and congested urban driving cycles, were assayed for mutagenicity in Salmonella typhimurium TA-100. Driving pattern did not significantly influence the mutagenic potency of the particle extracts or estimates of the amount of mutagenicity emitted from the exhaust despite large differences in particle emission rates observed under various driving conditions. The two vehicles were also operated at 25, 50, 75 and 100°F temperatures in the test chamber. Estimates of the amount of mutagenicity emitted per mile of vehicle operation increased slightly with increasing temperature in the Oldsmobile but decreased in the Volkswagen.

41639 (LMF—91, pp 235-239) **Exhaust particulate emissions during diesel engine break in.** Mokler, B.V.; Cheng, Y.S.; Dutcher, J.S.; Clark, C.R. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The characteristics of diesel exhaust particles are governed principally by operating conditions and engine type. A generally unexplored area is the influence of engine age on exhaust particle characteristics. Measurements were made during the break in period for two diesel engines intended for light duty vehicle use. No major changes in particle characteristics or mutagenicity of organic solvent extracts of the particles were observed during the first 10,000 miles of engine operation.

41640 (LMF—91, pp 240-243) **Comparison of the mutagenicity of spark-ignition and diesel engine exhaust particle emissions.** Clark, C.R.; Dutcher, J.S.; Brooks, A.L.; Naman, T.M.; Seizinger, D.E. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Extracts of exhaust particles from late model gasoline and diesel engine powered cars were extracted with dichloromethane and evaluated for mutagenicity in Salmonella typhimurium TA-100 (Ames test). Particle extracts from the gasoline cars were only slightly more mutagenic than those from diesel cars. Estimates of the mutagenic combustion products produced per mile of vehicle operation, however, were 10 to 100 times higher for the diesel vehicles due largely to the greater particulate emissions of the diesel cars.

41641 (LMF—91, pp 244-247) **Mutagenicity of spark-ignition engine exhaust particle extracts: influence of alcohol fuel extenders.** Clark, C.R.; Dutcher, J.S.; Naman, T.M.; Seizinger, D.E. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The particulate portion of the exhaust from four cars equipped with spark-ignition engines was collected on high volume filters after dilution in a tunnel. The cars were operated on unleaded gasoline, blends of unleaded gasoline with ethanol and methanol, and a commercially available gasohol. Dichloromethane extracts of the filter samples were assayed for mutagenicity in the Salmonella mutagenicity (Ames) test (TA-100). In general, the ethanol fuel blend resulted in particle extracts with lower mutagenicity than those obtained when operating the cars on unleaded gasoline alone. The mutagenic response to extracts of exhaust from the methanol and gasohol tests varied with vehicle type. Estimates of the amount of genotoxic combustion products emitted from the vehicles (revertants per mile) were consistently lower in all tests conducted with the alcohol blends.

41642 (LMF—91, pp 248-250) **Mutagenicity of used diesel crankcase oil.** Dutcher, J.S.; Clark, C.R. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The mutagenicity of used diesel crankcase oil was measured in Salmonella typhimurium. No activity was seen when the used oil was tested directly, but both direct and indirect were seen when dimethylsulfoxide extracts of the oil were tested. This is 1 to 1000 times less than the activity reported for used gasoline engine crankcase oil. Little additional mutagenic activity was found on the particles in the oil (< 12% of total) or in the oil filter (< 1% of total).

41643 (LMF—91, pp 251-254) **Mutagenicity and co-mutagenicity of diesel exhaust particle extracts in mammalian cells.** Li, A.P.; Brooks, A.L.; Royer, R.E.; Sun, J.D. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Diesel exhaust particle extracts had low genotoxicity in cultured Chinese hamster ovary cells. However, combined treatments of the cells with an exhaust particle extract and benzo(a)pyrene (BaP) yielded an observed genotoxicity higher than the expected value (the sum of their individual effects). This was observed using three assays for genotoxicity: mutation at the hypoxanthine-guanine phosphoribosyl transferase gene locus, Na, $^{+}K^{+}$-ATPase gene locus, and induction of sister chromatid exchange. The extract was found to oxidize reduced glutathione (GSH). Depletion of GSH that would otherwise react with and detoxify the mutagenic metabolites of BaP was postulated to be one of the mechanisms for our observation. Our finding suggests the presence of comutagens/co-carcinogens in diesel exhaust particle extracts which may play an important role in the health-risk effects of diesel exhaust.

41644 (LMF—91, pp 255-259) **Role of nitro-reductase enzymes in the mutagenicity of particulate air pollutants.** Clark, C.R.; Li, A.P.; Henderson, T.R.; Hanson, R.L.; Hadley, W.M. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Coal combustion fly ash and automotive and diesel soot, contribute significantly to ambient air particle concentrations. The mutagenic potencies of CH_2Cl_2 extracts of these particles may be largely due to nitro-substituted polycyclic aromatic hydrocarbons (PAH). These are potent mutagens in the widely used Salmonella tester strains, presumably because of the high nitroreductase activity of the bacteria. The mutagenicity of these extracts decreased significantly in nitroreductase deficient Salmonella strains, and only weak mutagenicity was detected when diesel exhaust extracts were tested in cultured mammalian cells devoid of nitro-reductase activity. These data suggest that the nitroreductase activity of bacteria may be responsible for the mutagenic response observed in particulate air pollutants and indicate an increased need for research on the role of nitroreductase enzymes in human toxicology.

41645 (LMF—91, pp 260-263) **Cytotoxicity of diesel exhaust particle extract: a comparison among five diesel passenger cars of different manufacturers.** Li, A.P.; Royer, R.E.; Brooks, A.L.; McClellan, R.O. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The cytotoxicity of the dichloromethane extracts of diesel exhaust particles from passenger cars of different manufacturers was studied in cultured Chinese hamster ovary cells. While exhaust particles from diesel cars of the same make and model yielded extracts of similar cytotoxicity, those from cars of different manufacturers yielded extracts with a threefold difference in cytotoxicity. Different toxicity rankings could be derived for the five cars using the cytotoxicity of the extracts, the cytotoxin content of the particles or the emissions of cytotoxic material into the environment per mile traveled.

41646 (LMF—91, pp 264-268) **In vitro evaluation of tumor promoting potential of diesel exhaust particles.** Zamora, P.O.; Gregory, R.E.; Brooks, A.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The potential of diesel exhaust particle extracts to act as tumor promoters was evaluated in vitro using mouse fibroblast 3T3 cells. Genotypic changes in the cells were assayed using a two-stage model of cell transformation. The loss of cell surface fibronectin was used as a marker of phenotypic change induced by tumor promoters. Extracts of diesel particles by themselves did not cause cell transformation; however, the transformation frequency of methylcholanthrene-initiated cultures was promoted when extracts of diesel exhaust particles were applied in repeated non-toxic doses. The amount of cell-surface fibronectin was substantially reduced on cells treated for 48 hours with non-toxic doses of extracts from diesel exhaust particles. The genotypic and phenotypic changes induced in 3T3 cells by diesel exhaust extracts were similar to those induced by tetradecanoyl phorbol acetate, a potent tumor promoter.

41647 (LMF—91, pp 271-275) **Evaluation of diesel exhaust particle extracts in the Salmonella intraperitoneal host-mediated assay.** Clark, C.R.; Shepherd, D.B. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The dichloromethane extract of particulate exhaust collected from a diesel passenger car was evaluated in the host mediated assay. Male CD-1 mice were gavaged orally with dosages of the particle extract ranging from 100 to 1000 mg/kg. Salmonella typhimurium strains TA-100 or TA-98 were injected intraperitoneally as indicators of exposure. After 6 hours of exposure, no increase in the mutation frequency was observed in TA-98 (100 to 500 mg/kg) but a slight increase was seen in TA-100 (500 to 1000 mg/kg). The results suggest that clearance of inhaled diesel particles to the gastrointestinal tract may not represent a serious health threat from the standpoint of oral absorption of mutagenic chemicals associated with the particles.

41648 (LMF—91, pp 276-279) **Activation and detoxification of diesel particles in vivo.** Brooks, A.L.; Dutcher, J.S.; Royer, R.E.; Clark, C.R.; McClellan, R.O. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Diesel exhaust particles or activated charcoal were placed in diffusion chambers and incubated in the peritoneal cavity of Beagle dogs or Fischer-344 rats. Mutagenic activity of dichloromethane (CH_2Cl_2) extracts of these particles was measured as a function of incubation times using the Ames test (TA-100 without S-9). In rats, the direct mutagenic activity of diesel particles increased, while in dogs the activity decreased afer 7 days incubation in vivo. The mutagenic activity of diesel particles incubated in rats for longer times decreased. The mutagenic activity of activated charcoal particle extracts was higher after 7 days of incubation in both the dog and the rat than the activity at day 0. Experiments to determine the cause of this pattern indicated that the increase in mutagenic activity was not related to the organic chemicals associated with the particles. The present hypothesis is that at short times, up to 7 days, a soluble mutagen was diffusing into the chambers and binding with the particles. This mutagen is then either lost or detoxified as a function of longer incubation times.

41649 (LMF—91, pp 293-296) **Acute and genetic toxicity of 1-nitropyrene and its fate following single oral doses to rats.** Marshall, T.C.; Royer, R.E.; Li, A.P.; Kusewitt, D.F.; Brooks, A.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

A suspension of 1-nitropyrene (NP) caused no acute toxicity and was not lethal when administered to male and female rats at single oral dosages as high as 5.0 g/kg. Urine and feces were collected for 4 days. About 70% of the dose was excreted in the feces as NP, while the reduced metabolite, 1-aminopyrene (AP), comprised about 2%. Sulfate and glucuronide conjugates of AP were present in small amounts ($< 1\%$) in the urine. Bone marrow cells from rats showed a slight dose related increase in the frequency of sister chromatid exchanges. Both NP and AP demonstrated low mutagenicity in Chinese hamster ovary cells in vitro. The weak in vivo and in vitro genetic toxicity of NP in mammalian systems suggests that the potential hazard may not be as high as that predicted from bacterial mutagenicity data.

41650 (LMF—91, pp 297-302) **Inhalation of diesel exhaust particles: exposure-dose relationships.** Wolff, R.K.; McClellan, R.O.; Henderson, R.F.; Griffis, L.C. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Current information on deposition and retention of diesel particles is summarized. Surrogate diesel particle studies with Beagle dogs showed pulmonary deposition to be 25 to 32% for 0.02 to 0.1 μm particles. These appear to be good estimates for deposition of diesel exhaust particles in humans. Pulmonary deposition in rats was considerably lower ($\sim$ 10%). Retention of actual diesel particles has been studied only in rats and was found to be typical of relatively insoluble particles. The long-term lung retention components of actual diesel particles had half-lives greater than 200 days following medium and high level exposures and a half-life of $<$ 100 days for low level exposures. These results are discussed as a model for deposition and retention of diesel exhaust particles, and some implications for human exposures are made.

41651 (LMF—91, pp 305-311) **Observations on rodents exposed for 19 weeks to diluted diesel exhaust.** Mauderly, J.L.; Benson, J.M.; Bice, D.E.; Henderson, R.F.; Jones, R.K.; McClellan, R.O.; Mokler, B.V.; Pickrell, J.A.; Redman, H.C.; Wolff, R.K. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Rats and mice were exposed by inhalation to diluted diesel exhaust for 545 hours during a 19-week period and examined for adverse health effects. Animals were exposed 7 hours/day, 5 days/week to exhaust at particle concentrations of 210, 1020 and 4380 $\mu g/m^3$ generated by a 5.7 liter General Motors engine operated on an urban cycle. Biological end-points included respiratory function, tracheal and deep lung particle clearance, immunological responses, biochemical and cytological parameters and morphology. The health effects at 19 weeks were minimal. No changes were found in respiratory function or particle clearance. Immune responses in lung-associated lymph nodes were elevated in rats and depressed in mice. Inflammation in lungs of high level exposed rats was indicated by increases in airway neutrophils and lung tissue proteases. Liver aryl hydrocarbon hydroxylase activity was reduced in exposed rats and mice, but liver cytochrome P_{450} activity was increased in high level exposed mice. Particles were found in aggregates of alveolar macrophages and in tracheobronchial lymph nodes. The remaining animals are being maintained for long-term observation.

41652 (LMF—91, pp 312-330) **Life span study of rodents inhaling diesel exhaust: experimental design and results through six months.** Mauderly, J.L.; Benson, J.M.; Bice, D.E.; Henderson, R.F.; Jones, R.K.; McClellan, R.L.; Mokler, B.V.; Pickrell, J.A.; Redman, H.C.; Wolff, R.K. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

A life span study of rodents exposed by inhalation to diluted diesel exhaust was initiated. Groups of 288 rats and 360 mice are being exposed 6 hours/day, 5 days/week to exhaust particle concentrations of approximately 7000, 3500 and 350 $\mu g/m^3$ generated alternately by two, 5.7 liter General Motors engines operated on an urban cycle. Similar numbers of animals are included as exposure chamber and colony controls. Animals are being observed for mortality, carcinogenesis and changes in body weight. Additional biological endpoints evaluated at 6-month intervals include lung particle burdens, respiratory function, tracheal and deep lung particle clearance, immunological responses, biochemical and cytologic parameters and morphology. After 6 months of exposure, mice had greater concentrations of particles in lung than did rats. There were no exposure-related differences in mortality, body weight, respiratory function or tracheal particle clearance. There was a dose-related slowing of deep lung clearance in rats, but not in mice. Cytological and biochemical indices indicated a dose-related inflammatory response in the lungs of both species, evident in rats and mice exposed to high levels and mice exposed to medium levels of diesel exhaust. Liver cytochrome P_{450} was elevated in female high-level mice and reduced in low- and medium-level male rats. Immunological responses of lung-associated lymph nodes were increased in high-level rats and mice. Intraalveolar diesel particles were found in single giant cells in mice and in aggregates of macrophages in rats. Particles were more prominent in pulmonary interstitium and lung-associated lymph nodes of both species than observed after shorter exposures. Exposures are continuing.

41653 (LMF—91, pp 331-334) **Evaluation of the potential health and environmental impacts of future light duty diesel vehicles.** Cuddihy, R.G.; Griffith, W.C.; Clark, C.R.; McClellan, R.O. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The potential environmental and health risks from increased use of diesel engine in light duty vehicles are being evaluated. Exhaust particles, nitrogen oxides and vapor phase hydrocarbons are thought to be the most important concerns. Because many other sources emit similar pollutants into the atmosphere, diesel vehicle emissions are only likely to be important contributors to pollutant levels in congested street canyons and parking garages and near well-traveled expressways. However, our evaluation indicates that increased lung cancer risk is probably too low to be detected even in people exposed to high levels of diesel exhaust. Diesel particles are not uniquely hazardous among environmental pollutants and cigarette smoking will continue to be the overwhelming cause of lung cancer in the United States population.

41654 (LMF—91, pp 388-392) **Clearance of coal combustion fly ash from rat lungs after acute inhalation exposure.** Griffis, L.C.; Snipes, M.B. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Rats were given nose-only exposures on consecutive days to an aerosol of either neutron-activated fluidized bed combustion (FBC) or pulverized coal combustion (PCC) fly ash. The activity in lungs for individual radionuclides in the fly ash was determined in 5 rats by obtaining high resolution gamma spectra of the same animal's thoracic region at different times from 5 to 155 days after inhalation exposure. The results indicated that ^{75}Se, ^{134}Cs, ^{60}Co and ^{54}Mn were preferentially dissolved from FBC fly ash and ^{75}Se was preferentially dissolved from PCC fly ash. The best activated tracers for either type of fly ash were ^{59}Fe and ^{46}Sc. The overall biological retention half-times for PCC (T/sub 1/2/ = 63 to 68 days) and FBC (T/sub 1/2/ = 68 to 84 days) fly ashes were similar, using ^{59}Fe and ^{46}Sc as their tracers.

41655 (LMF—91, pp 399-403) **Effect of sulfuric acid and fly ash inhalation on airway fluids and tracheal mucous clearance of guinea pigs.** Wolff, R.K.; Henderson, R.F. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Guinea pigs were exposed for 6 hours to 1 or 10 mg H_2SO_4/m^3 alone or in combination with 70 mg fly ash/m^3. Measurements were made of tracheal mucous clearance and an evaluation of lung damage was made from analysis of lung washings. Impairments in tracheal mucous clearance were found 1 day after exposures to 1 mg H_2SO_4/m^3 with and without fly ash. No significant changes were found at other times or concentrations although a tendency towards increased clearance was noted at high concentrations of H_2SO_4. Minor biochemical responses were found. There was an increase in protein in lung fluid 1 day after fly ash exposures, both with and without H_2SO_4, indicating increased alveolar permeability.

41656 (LMF—91, pp 404-407) **Subacute exposure of rats to low level nitrogen dioxide.** Gregory, R.E.; Pickrell, J.A.; Hahn, F.F. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The pulmonary effects resulting from exposure to low level NO_2 were investigated. Specific pathogen free Fischer-344 rats were exposed to 0, 1 or 5 ppM NO_2 or to 1 ppM NO_2 with two superimposed spikes to 5 ppM NO_2 7 hours/day, 5 days/week for up to 2.5 months. This exposure regimen produced a mild, dose-related pulmonary injury. Exposed animals showed evidence of airway cell dysfunction and oxidant-induced damage. Histological examination revealed focal areas of hyperinflation and alveolar macrophage accumulation in some exposed animals. After 2.5 months of exposure all biochemical indicators of lung injury had resolved but histopathological lesions persisted. These data suggest that chronic lung injury could develop with chronic exposure to low level NO_2.

41657 (LMF—91, pp 408-410) **Retention of particles in the upper respiratory tract of Beagle dogs after inhalation exposure.** Snipes, M.B. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Beagles were exposed by inhalation to either 0.7, 1.5 or 2.8 μm aerodynamic diameter (AD) or polydisperse particles of ^{134}Cs-labeled fused aluminosilicate. Radiation counting and autoradiography demonstrated the presence of radiolabeled particles in the upper respiratory tract for long times after inhalation exposure. Two years after deposition there was approximately 0.1 percent of the 2.8 μm AD particles, 0.01 percent of the 1.5 μm AD particles, or 0.001 percent of the 0.7 μm AD particles in the upper respiratory tract. Retention was particle-size dependent, perhaps due to the initial local deposition pattern or early clearance pattern. Larger particles of an aerosol would dominate the long-term burden in the upper respiratory tract but all particles would probably be retained to some extent to produce long-term irritation or physical damage.

41658 (LMF—91, pp 411-414) **Retention of polystyrene latex microspheres after instillation into the lungs of dogs.** Snipes, M.B.; Chavez, G.T.; Muggenburg, B.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Twenty-one Beagle dogs each had a mixture of 3, 9 and 15 μm polystyrene latex microspheres injected into their lungs. The 3 μm and 9 μm microspheres cleared to thoracic lymph nodes or the gastrointestinal tract, with the 3 μm size being cleared at a rate similar to what has been observed for inhaled particles of a similar size and the 9 μm size clearing more slowly. The 15 μm microspheres cleared the deep lung slowly. Results indicated that particles 9 to 15 μm diameter, while they have a low probability for deposition in the deep lung, would clear the lung slowly or not at all after deposition there. Results may be similar for large particles deposited in the lung by other means, including inhalation exposure.

41659 (LMF—91, pp 471-474) **Mutagenicity of process stream materials of an experimental low Btu coal gasifier.** Benson, J.M.; Clark, C.R.; Mitchell, C.E.; Newton, G.J. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Materials collected directly from process streams of an experimental low Btu coal gasifier have been evaluated for their mutagenic activity. Materials collected were mutagenic in the Ames Salmonella strain TA-98, but only with metabolic activation. Neutral and polar polynuclear aromatic compounds contributed to the mutagenic activity of the process stream material. Although specific mutagenic activity of process stream material was not greatly reduced by cleanup, large reduction in the mass loading (g of material/m^3 of process stream) led to a significant overall reduction in the mutagenic activity of the stream. Results indicate that potentially toxic materials are partially removed from the process stream and, assuming equal probability of fugitive emission throughout the stream, risk from exposure to fugitive emissions is reduced by gas cleanup.

41660 (LMF—91, pp 475-478) **Detection of tumor promoters using tracheal epithelial cell cultures.** Zamora, P.O.; Brooks, A.L.; Pickrell, J.A. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Pieces of rat trachea were embedded in collagen gels and maintained in tissue culture. Epithelial cells grew out from the explant and across the top of the gel as a stratified cell sheet which surrounded the explant by 5 days after initiating the culture. Additions of the potent tumor promoter, 12-0-tetradecanoyl-phorbol-13-acetate (TPA), to the culture medium resulted in rapid alterations in the epithelial cell morphology and decreased cell-to-cell contact. Two to three days after addition of TPA to the medium, large holes in the supporting gels were observed. An analysis of the culture medium indicated that hydroxyproline, or hydroxyproline-containing proteins, were released as a result of TPA stimulation, suggesting a secretion of collagenolytic enzymes by cells in the culture. The alterations in cell morphology and breakdown of the collagen gel were also observed in cultures treated with phorbol-12,13-didecanoate (PDD), another known tumor promoter. No effects were observed in cultures treated with the inactive analogs, 4-0-methyl TPA or 4α-PDD or the parent compound, phorbol. This system may be useful to test for the presence of tumor promoters in environmental pollutants.

41661 (LMF—91, pp 484-487) **Development of an in vitro primary lung culture system to evaluate the induction of sister chromatid exchanges.** Shimizu, R.W.; Brooks, A.L.; Richards, R.; Li, A.P. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

A sister chromatid exchange (SCE) test system was developed in primary Chinese hamster lung (CHL) cell cultures from Chinese hamsters to measure the genotoxic potential of compounds in the lung. The spontaneous SCE frequency of the CHL cells decreased from 0.53 to 0.38 SCE/chromosome in passages 1 and 20, respectively. This baseline value was comparable to the spontaneous SCE frequencies of the established Chinese hamster ovary (CHO) (0.53 SCE/chromosome) and V-79 (0.35 SCE/chromosome) transformed cell lines. However, the CHL spontaneous rate was higher than the spontaneous SCE frequency of an untransformed lung epithelial cell line (0.12 SCE/chromosome). The frequency of SCE's in the lung system increased as a function of dose to the known mutagen ethylmethane sulfonate (EMS) and the promutagen 3-methylcholanthrene (MCA). A dose of 200 μg/ml of EMS or 0.5 μg/ml of MCA caused a doubling of SCE frequency in the CHL system. The CHL system retained the metabolic capacity of activating promutagens and therefore appeared to be an appropriate system for measuring the potential for lung insult by xenobiotics.

41662 (LMF—91, pp 488-490) **Induction of chromosome aberrations and sister chromatid exchanges by benzo(a)pyrene in vitro and in vivo.** Brooks, A.L.; Li, A.P.; Mitchell, C.E. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Chromosome aberration and sister chromatid exchange (SCE) frequency were measured following benzo(a)pyrene (BaP) exposure in vitro or in vivo. Chinese hamster ovary (CHO) cells were evaluated after in vitro exposure, and bone marrow cells from Chinese hamsters were studied after either inhalation or intraperitoneal injection of BaP. A dose-related increase in the frequency of both SCE's and chromosome aberrations was observed in vitro. No increase in the aberration frequency was observed following inhalation of BaP. Following intraperitoneal injection, there was an increase in SEC's but no increase in chromosome aberration frequency. Exposure of CHO cells in vitro for 3 hours at 13 μg/ml produced a doubling of SCE frequency. A similar doubling of SCE's in bone marrow was observed after 3 injections of 150 mg BaP/kg body weight.

41663 (LMF—91, pp 493-495) **Distribution, retention and fate of inhaled 2-aminoanthracene in rats.** Mitchell, C.E. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Male Fischer-344 rats were exposed to 2-amino-[G-^{3}H]-anthracene aerosols (60 μg/l; AMAD, 1-2 μm) for one hour. significant quantities of radioactivity were found in the lung, liver and kidney immediately after exposure. Lower quantities of radioactivity were found in brain and muscle. Of the radioactivity found immediately after exposure, 90, 89 and 80% was cleared from the lung, liver and kidney, respectively, by 12 hours after exposure. Approximately 90% of the total radioactivity excreted in the feces and urine was eliminated the first 2 days after exposure.

41664 (LMF—91, pp 496-499) **Absorption and elimination of [^{14}C]-phenanthridone in Fischer-344 rats after inhalation exposure.** Dutcher, J.S.; Mitchell, C.E. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The biological fate of inhaled [^{14}C]-phenanthridone, an azaarene present in effluents from coal conversion processes, was studied in male Fischer-344 rats. Eighty-seven percent of the radioactivity initially detected in the lung was cleared by 12 hours. Elimination of radioactivity in urine and feces was rapid; 92 percent of the total urinary radioactivity and 83 percent of the total fecal radioactivity was excreted in 2 days.

41665 (LMF—91, pp 500-503) **Cytochrome P-450 dependent monooxygenases in the nose.** Dahl, A.R.; Hadley, W.M. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

The nasal turbinates and the epithelial lining of the nasal cavity were investigated for the presence of cytochrome P-450 dependent monooxygenases in dogs, rabbits, Syrian hamsters, guinea pigs, rats and mice. Activities of these enzymes in the nose were found to exceed even those of the liver in many cases. These enzymes can modify the toxicity of inhaled substances which deposit in the nose and may be important in maintaining low background levels of odorants in olfactory tissue.

41666 (LMF—91, pp 504-507) **Fate of inhaled benzo(a)pyrene in rats.** Mitchell, C.E. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Fischer-344 rats were exposed by inhalation to [^{3}H]benzo(a)pyrene (BaP) aerosols (500 μg/l; AMAD, 1-2 μm) for 1 hour. The concentration of organic-soluble, water-soluble and tissue-bound radioactivity was determined in the rat lung, liver and kidney at 0.5, 6, and 24 hours after exposure. At 0.5 hour after exposure, the organic-soluble radioactivity accounted for ~ 70% of the total radioactivity in the lung. The liver and kidney had 24 and 21%, respectively, of organic-soluble radioactivity at this time. The organic-soluble activity in the lung decreased to ~ 10% of the total radioactivity by one day after exposure; the percent of total lung radioactivity bound to tissue at this time was ~ 80%. Thin layer chromatography indicated that the organic-soluble radioactivity in the lung at 0.5 hour after exposure was composed primarily of 3-OH-BaP, 9-OH-BaP, and quinones of BaP. In contrast, the metabolites in liver tissue at 0.5 hour after exposure were primarily tetrols and dihydrodiols.

41667 (LMF—91, pp 530-533) **Deposition of UICC Crocidolite asbestos and glass microfibers inhaled by dogs.** Griffis, L.C.; McAllen, S.A.; Pickrell, J.A.; Carpenter, R.L.; Yerkes, K.L. Dec 1981. NTIS, PC A99/MF A01.

In Inhalation Toxicology Research Institute annual report, October 1, 1980-September 30, 1981.

Beagle dogs were given 60-minute nose-only exposures to an aerosol of either neutron-activated Crocidolite asbestos or glass microfibers. Deposition in the deep lung was determined from the activity in the lung 4 days after exposure. Deposition of the asbestos ranged from 12 to 19% of the aerosol inhaled, while deposition of the glass fibers ranged from 5 to 17%.

41668 **(PB—81-186025) Skeletal variants as an indicator of biological effects of environmental contaminants.** Beck, S.L. (Wheaton Coll., Norton, MA (USA). Dept. of Biology). Apr 1981. 213p. NTIS PC A10/MF A01.

The skeletal variant assay system (SVAS) explores the possible detection of subtle biological effects of in utero exposure to noxious substances. This was attempted even in the absence of gross malformations by an examination of a series of variations in development of adult skeletons. Several pesticides and a number of known teratogens were among the tested compounds. When necessary, toxicity tests were performed. Eighty-eight variants were selected for the study, using CD-1 mice. Prenatal studies included fetal skeletal parameters to provide comparability to teratogen studies.

41669 **(PB—81-190498) Interaction of acid sulfates and the respiratory system. Final report.** Covert, D.; Morgan, M.; Larson, T.; Frank, N.; Horike, N. (Washington Univ., Seattle (USA)). Apr 1981. 49p. NTIS PC A03/MF A01.

The objective of the research performed under this grant was to study certain aspects of the interaction of acid sulfate aerosol particles with the respiratory system.

41670 **(PB—81-190506) Effect of conventional and advanced coal conversion by-products on the pulmonary system.** Aranyi, C.; Bradof, J. (IIT Research Inst., Chicago, IL (USA). Life Sciences Div.). Apr 1981. 42p. NTIS PC A03/MF A01.

To evaluate the environmental impact of different energy technologies, fly ash samples collected from a coal-fired and from an oil-fired electric power plant were used in aerosol inhalation exposures of mice. The effects of multiple 3-h exposures to the fly ash particles at 2 and 1 mg/cu m aerosol mass concentration and <0.5 micrometer MMAD were evaluated in male and female mice by examining the changes in their pulmonary free cells, in their susceptibility to streptococcus infection, and in the bactericidal activity in their lungs to inhaled Klebsiella pneumoniae. Generally, no consistent differences could be discovered in the effects of the exposures between the two sexes. However, in a combined evaluation of both sexes, more and greater significant changes relative to controls were observed in the experimental parameters after inhalation of the oil power plant fly ash than after exposure to the coal fly ash. Thus, the overall results of the study indicate that the pulmonary defense system of mice was more adversely affected by the oil-fired power plant fly ash, a true stack emission effluent, than by the coal fly ash collected by electrostatic precipitator, an in-plant control device.

41671 **(PB—81-245730) Evaluation of mutagenic characteristics of diesel hydrocarbons. Technical report.** Penninga, T.J. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1981. 18p. (EPA-AA-TEB—81-22). NTIS, PC A02/MF A01.

The organic materials extracted from diesel particulate produce a positive mutagenic response in the Ames Salmonella test. Since a small amount of high molecular weight hydrocarbon material passes through particulate filters in a gaseous form, there has been a persistent concern that these gaseous organics may also be mutagenic. Several attempts at developing a test procedure to collect the gaseous organics behind particulate filters have failed due to inadequacy of the hydrocarbon absorbing media. This study evaluates previously exposed diesel particulate filters as a collection medium after the filters have been baked at about 1000 F to remove the particulate-bound organics.

41672 **(PB—81-853533) Hydrogen chloride air pollution. January 1970-November 1980 (citations from the NTIS Data Base). Report for January 1970-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 95p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations which deal with the control of acid emissions and their effect on health and plant life. Instrumentation for detection of acid emissions is also discussed, as well as control techniques used in industries which use large quantities of acid. (Contains 74 citations, fully indexed and including a table of contents.)

41673 **(PB—81-853541) Hydrogen chloride air pollution. January 1976-November 1980 (citations from the Energy Data Base). Report for January 1976-November 1980.** (New England Research Application Center, Storrs, CT (USA)). Nov 1980. 69p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations which deal with the control of acid emissions and their effect on health and plant life. Instrumentation for detection of acid emissions is also discussed, as well as control techniques used in industries which use large quantities of acid. (Contains 52 citations, fully indexed and including a table of contents.)

41674 **Noncovalent binding of 7β,8α-dihydroxy-9α,10α-epoxytetrahydrobenzo[a]pyrene to deoxyribonucleic acid and its catalytic effect on the hydrolysis of the diol epoxide to tetrol.** Geacintov, N.E. (New York Univ., New York); Yoshida, H.; Ibanez, V.; Harvey, R.G. *Biochemistry;* **21**: No. 8, 1864-1869(13 Apr 1982). Contract AC02-78EV04959;E(11-11)2386.

In the presence of native DNA the hydrolysis of benzo[a]pyrene-7,8-diol 9,10-epoxide (BPDE) to tetrols (BPT) is markedly accelerated (by a factor of up to ~80 at 25° C, pH 7.0, in 5 mM sodium cacodylate buffer solution). When stopped-flow kinetic techniques are utilized, it is shown that the pseudo-first-order hydrolysis rate constant k/sub H/ is smaller by a factor of ~3 in the presence of equivalent concentrations of denatured DNA, by a factor of 8-25 in the presence of nucleotides, and by a factor of 35-45 in the presence of nucleosides (depending on the nucleotide or nucleoside). In the presence of native DNA, k/sub H/ increases with increasing DNA concentration and reaches a limiting value of k/sub H/ = 0.684 +/- 0.04 s/sup -1/ at DNA concentrations in excess of ~5 X 10/sup -4/ M (expressed in concentration of nucleotides). A kinetic model based on (1) rapid formation of a noncovalent BPDE-DNA complex followed by (2) slower hydrolysis of BPDE to BPT at these binding sites is consistent with the experimental data. It is shown furthermore that the DNA is similar and that addition of magnesium ions (which is known to reduce intercalative binding of planar aromatic molecules to DNA) also reduces k/sub H/. These results suggest, but do not necessarily

prove, that DNA binding sites at which the hydrolysis of BPDE (to BPT) is catalyzed are intercalative in nature.

41675 **Activity of nitro-polynuclear aromatic hydrocarbons in the sister chromatid exchange assay with and without metabolic activation.** Nachtman, J.P. (Univ. of California, Berkeley); Wolff, S. *Environmental Mutagenesis;* **4**: No. 1, 1-5(1982).

Nitro-polynuclear aromatic hydrocarbons are found in diesel particulates.These compounds are potent mutagens in the Ames test. To determine whether nitro-polynuclear aromatic hydrocarbons are active in a mammalian cell assay, 1-nitropyrene, 1,8-dinitropyrene, 2-nitrofluorene, and 4-nitrobiphenyl were incubated with cultures of Chinese hamster ovary cells. The frequency of sister chromatic exchange (SCE) was measured in the presence and absence of rat liver S-9 mix. The addition of S-9 mix resulted in a large increase in the SCEs induced by all four compounds.

41676 **Cytotoxicity and mutagenicity of dimethylnitrosamine in mammalian cells (CHO/HGPRT system): enhancement by calcium phosphate.** O'Neill, J.P. (Oak Ridge National Lab., TN); Machanoff, R.; San Sebastian, J.R.; Hsie, A.W. *Environmental Mutagenesis;* **4**: No. 1, 7-18(1982). Contract W-7405-ENG-26.

The cytotoxicity and mutagenicity of dimethylnitrosamine (DMN) was determined in the CHO/HGPRT system. Metabolic activation of the promutagen was achieved by use of a liver homogenate supernatant (S9) prepared from Aroclor 1254-induced Sprague-Dawley rats. The cytotoxic and mutagenic effects of DMN were enhanced by the inclusion of calcium chloride in the incubation mix, and this enhancement was dependent on the presence of sodium phosphate. Under conditions that yielded maximal activity (10 mM calcium chloride, 10 mM magnesium chloride, 50 mM sodium phosphate), an apparent calcium phospate precipitate was observed. DMN activity increased with increasing amounts of S9 protein over the range 0.3-3.0 mg/ml in the S9 mix and appeared to plateau at higher concentrations. The mutagenicity of DMN can be described as 110 mutants/10^6 cells per mM DMN per mg/ml S9 protein per hour.

41677 **Effect of several metal ions on misincorporation during transcription.** Niyogi, S.K.; Feldman, R.P. (Oak Ridge National Lab., TN). *Nucleic Acids Research;* **9**: No. 11, 2615-2627(11 Nov 1981). Contract W-7405-ENG-26.

By use of poly(dA-dT) as template and Escherichia coli RNA polymerase, several metal ions were tested for their effect on the efficiency of transcription and on the misincorporation of CMP into the poly(rA-rU) product. In the presence of 10 mM $MgCl_2$, Mn^{2+} has a stimulatory effect on the transcription, Co^{2+} has very little effect on the reaction, Cu^{2+} and Zn^{2+} are strongly inhibitory, and Cd^{2+} and Ni^{2+} are less inhibitory. The background misincorporation of CMP in the presence of $MgCl_2$ is about 1 nucleotide per 2000 correct nucleotides incorporated and is independent of Mg^{2+} concentration. Zn^{2+}, Ca^{2+}, Sr^{2+}, Li^+, Na^+, and K^+ - all nonmutagenic and noncarcinogenic - do not increase misincorporation. Mn^{2+} causes a concentration-dependent threefold increase in the misincorporation that can be slightly reversed at higher $MgCl_2$ concentrations. Cd^{2+} causes a dramatic increase in the misincorporation with increasing $CdCl_2$ concentration that can be substantially overcome by higher concentrations of Mg^{2+}.Cu^{2+} also increase the misincorporation, Ni^{2+} slightly increases it, and Co^{2+} does not increase it at all. Several control experiments indicate that the misincorporation of CMP is dependent on the template-directed synthesis of poly(rA-rU). Nearest-neighbor analysis indicates that CMP is incorporated in place of UMP into the poly(rA-rU) product. The increase in misincorporation appears to be related both to the "hard-soft" character of the metal ions and to their carcinogenic potential.

41678 **Effect of the tumor promoter 12-O-tetradecanoylphorbol-13-acetate on α-aminoisobutyrate uptake in friend erythroleukemic cells.** Becker, J.H. (Oak Ridge National Lab., TN); Cook, J.S. *Cancer Research;* **41**: 4512-4517(Nov 1981). Contract W-7405-ENG-26.

In Friend erythroleukemic cells, the tumor promoter 12-O-tetradecanoylphorbol-13-acetate (TPA) increases the rate of influx as well as the steady-state accumulation of the amino acid transport probe α-aminoisobutyric acid (AIB). This non-metabolizable analog is concentrated in these cells by utilizing the energy of the Na^+ electrochemical gradient. The effect of TPA is to increase the ouabain-sensitive component of uptake of AIB (and of the K^+ analog $^{86}Rb^+$). Transport changes are not observed until 30 min after application of the promoter and reach a maximum in about 6 hr. The effects are blocked by cycloheximide. The flux results are consistent with a model in which the membrane potential is increased and, with it, the driving force on the coupled Na^+-AIB movement. The effect is possible mediated by a change in electrogenicity of the Na:K pump. TPA raises the steady-state accumulation levels of AIB. By altering external K^+ in the presence of valinomycin, the membrane potential may be adjusted and, with it, the accumulation of AIB. Over a wide range of membrane potentials, TPA-treated cells accumulate more AIB than do controls, suggesting a possible change in the internal Na^+ activity.

41679 **Sperm studies in anesthesiologists.** Wyrobek, A.J. (Lawrence Livermore National Lab., CA); Brodsky, J.; Gordon, l.; Moore, D.H., II; Watchmaker, G.; Cohen, E.N. *Anesthesiology;* **55**: No. 5, 527-532(Nov 1981). Contract W-7405-ENG-48.

Semen samples were collected from 46 anesthesiologists each of whom had worked a minimum of one year in hospital operating rooms ventilated with modern gas-scavenging devices. Samples collected from 26 beginning residents in anesthesiology served as controls. Concentrations of sperm and percentage of sperm having abnormal head shapes were determined for each sample. No significant differences were found between anesthesiologists and beginning residents. Limiting the analyses to men having no confounding factors (varicocele, recent illness, medications, heavy smoking, frequent sauna use) did not change the results. The sperm concentration and morphology in 13 men did not change signficantly after one year of exposure to anesthetic gases. However, the group of men who had one or more confounding factors (excluding exposure to anesthetic gases) showed significantly higher percentages of sperm abnormalities than did the group of men without such factors. These results suggest that limited exposure to anesthetic gases does not significantly affect sperm production as judged by changes in sperm concentration and morphology. These data are reassuring, but since the hospitals surveyed used modern gas-scavenging devices, men who are occupationally exposed to anesthetic gases without this protection should be studied for fuller assessment of the possible human spermatotoxic effects.

41680 **Binding of benzo(a)pyrene derivatives to specific proteins in nuclei of intact hamster embryo cells.** MacLeod, M.C. (Oak Ridge National Laboratory, TN); Kootstra, A.; Mansfield, B.K.; Slaga, T.J.; Selkirk, J.K. *Cancer Research;* **41**: 4080-4086(Oct 1981). Contract W-7405-ENG-26.

In hamster embryo cells incubated for 24 hr with 4 μm [^{3}H]benzo(a)pyrene, a major portion of the nonextractable radioactivity in nuclear preparations copurifies with the protein fraction. When these proteins are analyzed by sodium dodecyl sulfate:polyacrylamide gel electrophoresis, significant variations in the labeling intensities of the various proteins are seen. Control experiments demonstrate that the labeling is due to covalent binding to protein. Histones H3 and H2A are heavily labeled while the other histones of the nucleosome core, H2B and H4, are deviod of radioactivity. Large amounts of label are associated with proteins with mobilities similar to the very lysine-rich histones H1. However, the results of differential extraction experiments suggest that the labeled proteins do not belong to either the H1 or the high-mobility-group class of chromosomal proteins. During 6 hr of inhibition of protein synthesis by cycloheximide, the metabolism of [^{3}H]-benzo(a)pyrene, as monitored by high-pressure liquid chromatography, remained normal. Patterns of labeling of nuclear proteins after 3 or 6 hr were identical in the presence and absence of cycloheximide. This finding strongly suggests that binding of benzo(a)pyrene derivatives to nuclear proteins occurs in situ.

41681 **Studies on nitrosamine metabolism. III. Comparison of the subcellular distribution of radioactivity in tissues of REM and BALB/c mice following administration of [^{14}C]diethylnitrosamine.** Daugherty, J.P.; Clapp, N.K. (Univ. of Alabama School of Medicine, Birmingham). *Research Communications in Chemical Pathology and Pharmacology;* **34**: No. 1, 165-168(Oct 1981). Contract W-7405-ENG-26.

The tissue distribution of radioactivity in male RFM and BALB/c mice was investigated following a single dose of [^{14}C]-labeled diethylnitrosamine (DEN). The radiolabel was associated with all the subcellular fractions, and the majority of the radioactivity was located in the cytosol fraction. The majority of the radiolabel was usually eliminated from the fractions within 16-24 hrs after [^{14}C]DEN administration.

41682 **Tumor promoters alter gene expression and protein phosphorylation in avian cells in culture.** Laszlo, A. (Lawrence Berkeley Lab., CA); Radke, K.; Chin, S.; Bissell, M.J. *Proceedings of the National Academy of Sciences of the United States of America;* **78**: No. 10, 6241-6245(Oct 1981). Contract W-7405-ENG-48.

We have investigated the effect of 12-O-tetradecanoylphorbol 13-acetate (TPA) on the synthesis and modification of polypeptides in normal avian cells and cells infected by wild-type and temperature-sensitive Rous sarcoma virus (RSV). Using two-dimensional gel electrophoresis, we have detected alterations in both the abundance of cellular polypeptides and in their phosphorylation that seem unique to TPA treatment. However, the state of phosphorylation of the major putative substrate for the action of the src gene-associated protein kinase, the 34- to 36-kilodalton protein, was not altered. Moreover, examination of the phosphorylated amino acid content of total cellular phosphoproteins revealed that the response to TPA was not associated with detectable increases in their phosphotyrosine content. These results make it unlikely that TPA acts by the activation of the phosphorylating activity of the cellular proto-src gene or by the activation of other cellular phosphotyrosine-specific kinases. We have shown previously that temperature-sensitive RSV-infected cells at nonpermissive temperature demonstrate an increased sensitivity to TPA treatment [Bissell, M.J., Hatie, C. & Calfin, M. (1979) Proc. Natl. Acad. Sci. USA 76, 348-352]. Our present results indicate that this is not due to reactivation of the phosphorylating activity of the defective src gene product or to its leakiness, and they lend support to the notion of multistep viral carcinogenesis.

41683 **Response of pinto bean plants exposed to O_3, SO_2, or mixtures at varying temperatures.** Miller, C.A.; Davis, D.D. (Pennsylvania State Univ., University Park). *HortScience;* **16**: No. 4, 548-550(Aug 1981). Contract EE-775024497.

Pinto bean plants (Phaseolus vulgaris L. ev. Pinto 111) in the uniforliolate leaf stage were exposed for 3 hours to 0.8 ppm SO_2, 0.25 ppm O_3 or a mixture of the 2 pollutants at these concentrations at 15, 24, or 32°C. Foliage exposed to O_3 alone developed adaxial stipple and leaves exposed to SO_2 alone developed interveinal necrosis. The mixture of O_3 and SO_2 induce O_3-type symptoms at 32° and SO_2-type symptoms at 15°. Both symptom types were present at 24°. Some abaxial glazing or silvering was also induced by the mixture, and was most common at 15° and 24°. Ozone and SO_2 each induced greater foliar injury at 15° or 32°, as compared to 24°. The mixture of O_3 and SO_2 induced greatest macroscopic foliar injury at 15°. The degree of adaxial vs abaxial leaf surface injury varied with temperature.

41684 **Metabolism of benzo(a)pyrene by murine embryonal carcinoma cells.** Filler, R.; Garner-Shinpock, S. (Oak Ridge National Lab., TN). *Cancer Research;* **41**: 1104-1109(Mar 1981). Contract W-7405-ENG-26.

Murine embryonal carcinoma (EC) cells were characterized with respect to their ability to metabolize the polycyclic aromatic hydrocarbon, benzo(a)pyrene [B(a)]. The extent of metabolic activation varied more than 100-fold among the teratocarcinoma-derived cell lines examined. This difference in metabolic activity was correlated with an increase in the formation of specific metabolites that were identified by high-pressure liquid chromatography. Maximal in vitro formation of water-soluble products occurred 24 hr after the addition of [^{3}H]B(a)P to the EC cells. Long-term incubation of EC cells with [^{3}H]B(a)P indicated that, within the initial 24 hr, 2.3% of the input had been taken up by the cells. Subcellular analysis of the distribution of radioactivity indicated that 70 to 80% of intracellular radioactivity was associated with isolated nuclei. Therefore, the intranuclear metabolites of B(a)P were also analyzed by high-pressure liquid chromatography. Embryonal carcinoma cell lines OC15S1 and C86S1 showed significant in vitro toxic effect to B(a)P over a concentration range of 0.05 to 0.3 μg/ml, whereas F9 and PC13 were resisstant to concentrations of B(a)P up to 5 μg/ml. Equally resistant to B(a)P was the PYS cell line, a differentiated cell type derived from EC cells. Cytotoxicity was related to the extent of metabolic activation of parent compound.

41685 **Modification of sodium and potassium channel gating kinetics by ether and halothane.** Bean, B.P.; Shrager, P.; Goldstein, D.A. (Univ. of Rochester Medical Center, NY). *Journal of General Physiology;* **77**: 233-253(Mar 1981). Contract AC02-76EV03490.

The effects of ether and halothane on the kinetics of sodium and potassium currents were investigated in the crayfish giant axon. Both general anesthetics produced a reversible, dose-dependent speeding up of sodium current inactivation at all membrane potentials, with no change in the rising phase of the currents. Double-pulse inactivation experiments with ether also showed faster inactivation, but the rate of recovery from inactivation at negative potentials was not affected. Ether shifted the midpoint of the steady-state fast inactivation curve in the hyperpolarizing direction and made the curve steeper. The activation of potassium currents was faster with ether present, with no change in the voltage dependence of steady-state potassium currents. Ether and halothane are known to perturb the structure of lipid bilayer membranes; the alterations in sodium and potassium channel gating kinetics are consistent with the hypothesis that the rats of the gating processes of the channels can be affected by the state of the lipids surrounding the channels, but a direct effect of ether and halothane on the protein part of the channels cannot be ruled out.

41686 **The induction of chromosome-type aberrations in G_1 by methyl methanesulfonate and 4-nitroquinoline-N-oxide, and the non-requirement of an S-phase for their production.** Preston, R.J.; Gooch, P.C. (Oak Ridge National Lab., TN). *Mutation Research;* **83**: 395-402(1981). Contract W-7405-ENG-26.

Human lymphocytes were treated in G_1 with 4-nitroquinoline-N-oxide (4NQO) and methyl methanesulfonate (MMS) and then incubated in the presence or absence of cytosine arabinoside (ara-C). There was an increase in aberratin frequency in those cells incubated with ara-C compared with those treated with 4NQO or MMS alone. This increase was restricted to chromosome-type aberrations. When cells were treated in G_2 with 4NQO and then incubated with ara-C until fixation, there was an increase in deletions compared with cells treated with 4NQO alone. No exchange aberrations were observed following any treatment even when deletion frequencies were high, as in the case with 4NQO plus ara-C treatment. These results suggest that ara-C can inhibit the repair of DNA damage induced by 4NQO and MMS that is converted into aberrations. They also show that the terms "S-dependent" and "S-independent" used to describe the modes of action of chemical clastogens are not valid.

41687 **Effect of calcium phosphate and alumina Cy gels on the mutagenicity and cytotoxicity of dimethylnitrosamine as studied in the CHO/HGPRT system.** Tan, E.L. (Univ. of Tennessee, Oak Ridge); Hsie, A.W. *Mutation Research;* **84**: 147-156(1981). Contract W-7405-ENG-26.

When $CaCl_2$ was added in increasing concentrations to a rat liver metabolic activation system (S9) buffered with sodium phosphate, the mutagenic activity and cytotoxicity of dimethylnitrosamine (DMN) in the Chinese hamster ovary cell/hypoxanthine-guanine phosphoribosyl transferase (CHO/HGPRT) system were greatly increased. This effect was not observed with an S9 mix buffered with N-2-hydroxyethylpiperazine-N'-2-ethanesulfonic acid (HEPES). The calcium phosphate gel precipitate of the S9 mix pos-

sessed approximately 1/3 of the total activity of the mix, while the supernatant had only slight activity. However, when the calcium phosphate gel precipitate of a solution of S9 salts (without S9 protein) was added to the supernatant, the remaining 2/3 of the activity was recovered. Commercially obtained calcium phosphate, tricalcium phosphate, and alumina Cγ gels could substitute for $CaCl_2$ in the S9 mix, but diethylaminoethyl cellulose (DEAE cellulose) could not. Alumina Cγ gel can exert its effect in the absence of both $CaCl_2$ and phosphate in the S9 mix. Increasing the time of contact between the S9 protein and the S9 salts increased the efficacy with which the S9 mix activated DMN; this is indicative of an adsorptive process by calcium phosphate gel.

41688 **Effect of sodium azide on sister-chromatid exchanges in human lymphocytes and Chinese hamster cells.** Arenaz, P.; Nilan, R.A. (Washington State Univ., Pullman). *Mutation Research;* **88**: 217-221(1981). Contract AM06-76RL02221.

Sodium azide is highly mutagenic in S. typhimurium TA1530 as well as in barley, rice, peas, yeast and Chinese hamster V79 cells. However azide apparently does not produce chromosome breaks in barley, Vicia or human lymphocytes. Human whole blood and Chinese hamster K1 cell line were exposed for 4 and 2 h resp. to various concentrations of sodium azide ranging from 10^{-3} to 10^{-7} M. Cells were harvested and chromosomes stained by the FPG technique. In human lymphocytes, concentrations above 10^{-4} induced lethality whereas the K1 cell line was sensitive to concentrations above 10^{-5} M.The lower concentrations of azide produced no significant increase in SCE frequency above controls. Concurrent mitomycin C treatments produced significant increases in SCE levels. This apparent lack of induction of SCEs above background combined with previous data demonstrating negative clastogenic but very positive mutagenic activity of azide confirms the uniqueness of this mutagen. It would appear that azide is one of the few known potent mutagens that does not increase SCEs and/or break chromosomes.

41689 **Quantitative analysis of cytotoxicity and mutagenicity of benzo[a]pyrene in mammalian cells (CHO/HGPRT system).** Machanoff, R.; O'Neill, J.P.; Hsie, A.W. (Oak Ridge National Lab., TN). *Chemico-Biological Interactions;* **34**: 1-10(1981). Contract W-7405-ENG-26.

Chinese hamster ovary (CHO) cells in cell culture were utilized to study the cytotoxic and mutagenic activity of benzo[a]pyrene (BP). A liver homogenate (S9) prepared from Arochlor 1254 induced male Sprague-Dawley rats was employed to mediate the biotransformation of the promutagen. The dependence of the induction of 6-thioguanine(TG)-resistant mutants on parameters such as BP concentration, amount of S9 protein, ionic composition of the S9 mix and treatment time was determined. Under optimal conditions with a 5-h treatment time, BP mutagenicity can be described as 185 mutants/10^6 cells per μM BP per mg/ml S9 protein.

41690 **Quantitative estimation of the extent of alkylation of DNA following treatment of mammalian cells with non-radioactive alkylating agents.** Snyder, R.D. (Univ. of Tennessee, Oak Ridge); Regan, J.D. *Mutation Research;* **91**: 307-314(1981). Contract W-7405-ENG-26.

Alkaline sucrose sedimentation has been used to quantitate phosphotriester formation following treatment of human cells with the monofunctional alkylating agents methyl and ethyl methanesulfonate. These persistent alkaline-labile lesions are not repaired during short-term culture conditions and thus serve as a useful and precise index of the total alkylation of the DNA.Estimates of alkylation by this procedure compare favorably with direct estimates by use of labeled alkylating agents.

41691 **Environmental pollutant 5-chlorouracil is incorporated in mouse liver and testes DNA.** Pal, B.C.; Cumming, R.B.; Walton, M.F.; Preston, R.J. (Oak Ridge National Lab., TN). *Mutation Research;* **91**: 395-401(1981). Contract W-7405-ENG-26.

Our aquatic environment contains 5-chlorouracil and 5-chlorouridine among other chloro-organics as a result of chlorination of sewage. Mice ingesting 5-chlorouracil in their drinking water incorporate the base heavily in the liver and testes DNA. Another related metabolite, 5-chlorodeoxyuridine, is 5 times more potent than 5-bromodeoxyuridine in inducing sister-chromatid exchanges in Chinese hamster ovary cells.

41692 **Mutagens from the cooking of food. I. improved extraction and characterization of mutagenic fractions from cooked ground beef.** Felton, J.S. (Lawrence Livermore Lab., CA); Healy, S.; Stuermer, D.; Berry, C.; Timourian, H.; Hatch, F.T. *Mutation Research;* **88**: 33-44(1981). Contract W-7405-ENG-48.

Ground beef was fried at 200°C (392°F) to a well-done, non-charred state, and the extracted organic base fraction was found to be highly mutagenic in Salmonella strain TA1538 (6300 revertants/100 g equivalent, gE, fresh weight). The neutral and acidic extracts showed no mutagenic activity in any of the 5 standard strains of Salmonella. A new procedure based upon extraction and protein precipitation with acetone is described, which is simpler and more efficient than previously described methods. The organic base fraction was mutagenic only in Salmonella strains FA1537, TA1538, and TA98, all sensitive to frameshift mutations. Strains sensitive to base-substitution mutations showed no activity. Metabolic activation was an absolute requirement for mutagenesis; however cell toxicity was decreased by the presence of S9 activation mixture. After normal cooking, more than 20 times as much mutagenic material remained in the meat as was recovered in the pan grease and vapors. The results confirm that mutagens are formed under conventional frying conditions, and show that mutagen can be isolated by an improved extraction method.

41693 **Nitrosamine-induced mutagenesis in Escherichia coli K12 (343/113) 1. mutagenic properties of certain aliphatic nitrosamines.** Rao, T.K.; Allen, B.E.; Winton, W.; Lijinsky, W.; Epler, J.L. (Oak Ridge National Lab., TN). *Mutation Research;* **89**: 209-215(1981). Contract W-7405-ENG-26.

The Escherichia coli K12 (343/113) test system developed by G. Mohn was used to detect the mutagenic activity induced by a group of aliphatic nitrosamines. Metabolic activation was incorporated into the assay by the addition of liver homogenates induced in either Sprague-Dawley rats or C_3H mice with the addition of 0.1% phenobarbital to the drinking water. Nitrosodiethylamine (NDEA) was mutagenic upon metabolic activation and exhibited a preference to revert the missense mutation at the arginine locus. NDEA was also capable of inducing the forward mutation, selected as an ability to utilize galactose. NDEA was converted effectively into a mutagen in a time period of 30 min to 2 h. Metabolic activation with the mouse and rat liver preparations did not result in quantitative differences. Aliphatic nitrosamines that gave unexpected results with the Salmonella assay [4-10] were examined in the E. coli system. Nitrosodipropylamine (NDPA) and nitrosodiallylamine (NDAA) were mutagenic in both E. coli and Salmonella. Nitrosomethylethylamine (NMEA) was not mutagenic in Salmonella but was mutagenic in E. coli, and a strong carcinogen, nitrosomethylneopentylamine (NMNA), was not mutagenic in either assay. These results indicate the use of multiple genetic assays for the detection of genotoxic chemicals in our environment.

41694 **Selective effects of metal ions on RNA synthesis rates.** Niyogi, S.K. (Oak Ridge National Lab., TN); Feldman, R.P.; Hoffman, D.J. *Toxicology;* **22**: 9-21(1981). Contract W-7405-ENG-26.

The effects of 14 metal ions (chlorides) on the transcription of calf thymus DNA and phage T4 DNA with Escherichia coli RNA polymerase were tested. These assays were conducted under improved conditions of lower pH and in the absence of 2-mercaptoethanol to permit greater stability of the metal ions in solution. Among the divalent metal ions tested, the concentration-dependent order of inhibition of overall transcription is $Pb^{2+} > Zn^{2+} > Cu^{2+} > Be^{2+} > Cd^{2+} > Ni^{2+} > Ca^{2+} > Co^{2+} > Mn^{2+} > Mg^{2+} > Sr^{2+}$ and is the same with either template. At pH 7.4 and in the absence of 2-mercaptoethanol, considerably lower concentrations of several of the divalent metal ions are needed for inhibition of of overall transcription than at pH 8.1 and in the presence of 2-mercaptoethanol. Ca^{2+}, Mg^{2+}, Sr^{2+}, Zn^{2+}, Li^{+}, Na^{+}, and K^{+} - considered to be

non-mutagenic and non-carcinogenic - decrease chain initiation (measured with T4 DNA) at concentrations that inhibit overall transcription. Pb^{2+}, Cd^{2+}, Co^{2+}, Be^{2+}, and Mn^{2+} - all mutagenic or carcinogenic - stimulate chain initiation (although at widely different rates) at concentrations that inhibit overall transcription. Cu^{2+} and Ni^{2+} - both carcinogenic - stimulate initiation only at very low concentrations, followed by a progressive decrease in initiation at concentrations that inhibit overall transcription.

41695 **The major adducts of cis and trans benzo[a]pyrene diol epoxides cause chain termination during DNA synthesis in vitro.** Yamaura, I.; Rosenberg, B.H.; Cavalieri, L.F. (Sloan-Kettering Inst., Rye, NY). *Chemico-Biological Interactions;* **37**: 171-180(1981). Contract AC02-79-EV-10263.

DNA synthesis has been studied in vitro using as template phiX174 DNA containing varying numbers of adducts formed by reaction with cis and trans benzo[a]pyrene (BP) diol-epoxides. The extent of DNA synthesis decreases with increasing numbers of adducts and there is a concomitant decrease in the size of the DNA products. Both decreases can be accounted for quantitatively by the assumption that synthesis terminates at every BP adduct. Since the majority of the adducts are located at the 2-amino group of guanine, we deduce that these adducts cause termination. The role of adducts at other sites is uncertain. The cis and trans BP diol-epoxides are indistinguishable with regard to chain termination, yet in vivo these isomers behave differently. These results suggest that chain termination alone is insufficient to account for the mutagenic effects of BP diol-epoxides.

41696 **Seed yields (quantity and quality) of field-grown soybeans exposed to simulated acidic rain.** Evans, L.S. (Brookhaven National Lab., Upton, NY); Lewin, K.F.; Conway, C.A.; Patti, M.J. *New Phytologist;* **89**: 459-470(1981). Contract AC02-76CH00016.

Experiments were performed to determine changes in mass, protein content and carbohydrate content of seeds of soybean plants exposed to simulated acidic rain grown under standard agronomic practices and receiving ambient rainfall at Brookhaven National Laboratory during the summer of 1979. Plots were exposed three times per week to simulated rainfalls of pH 4.0, 3.1, 2.7 or 2.3 to provide inputs of 50, 397, 998 or 2506 μequiv. of hydrogen ions respectively, above ambient levels throughout the growing season. Control plots received no simulated rainfall treatments. The results indicate significant differences by both analysis of variance and two-tailed t-tests. These additional hydrogen ions decreasd seed yields by 2.6, 6.5, 11.4 and 8.5%, respectively. A treatment-response function was determined between the hydrogen ion concentration of the treatments and seed yield. This function, $y = 21.06 - 1.01 \log x$, has a correlation coefficient of minus 0.90 and its slope is significantly different from zero. Decreased yields were attributed to a decrease in number of pods per plant since seed number per pod and mass per seed did not vary among the treatments. On a per plant basis, total seed protein decreased by 10 and 19% in plants exposed to simulated rainfalls. At these same treatment levels total non-structural carbohydrates did not decrease significantly. The results show that additional increments of simulated acidic rain can decrease seed biomass and protein content of field-grown soybeans.

41697 **Responses of leaves of Phaseolus vulgaris L. to simulated acidic rain.** Evans, L.S. (Manhattan Coll., Bronx, NY); Curry, T.M.; Lewin, K.F. *New Phytologist;* **88**: 403-420(1981). Contract AC02-76CH00016.

Relative rates of nutrient penetration, nutrient leaching, and cell permeability of first trifoliate leaves of Phaseolus vulgaris L. cv. Univ. of Idaho 111 were examined after exposure to simulated acidic rain. In buffer solutions $^{35}SO_4^{2-}$ penetrated leaves faster at pH 2.7 than at 5.7. In contrast, $^{86}Rb^+$ pervaded fastest at pH 5.7, and ^3H_2O entered foliage at similar rates at all pH levels tested. When plants were exposed to simulated rains of various pH levels, calcium, nitrate and sulphate were preferentially leached from whole leaves by rainfalls of low pH, whereas potassium and chloride leached more at pH 5.7 and 3.4 compared with 2.7 and 2.9. Isotope tests indicated that cells within leaves were more permeable to $^{35}SO_4^{2-}$ and ^3H_2O and less permeable to $^{86}Rb^+$ at pH 2.7 than at higher pH levels. These results suggest a wide diversity of leaf and cell permeability responses to various ions after exposure to acidic rain. In general, an increased rate of nutrient leaching at more acidic levels was correlated with a lower adaxial leaf resistance during leaf development.

41698 **Microsomal activation of selected polycyclic aromatic hydrocarbons and aromatic amines in Drosophila melanogaster.** Nix, C.E.; Brewen, B.; Epler, J.L. (Oak Ridge National Lab., TN). *Mutation Research;* **88**: 291-299(1981). Contract W-7405-ENG-26.

Benzo[a]pyrene, 7,12-dimethylbenz[a]anthracene, 2-acetylaminofluorene, 2-aminoanthracene, and 1-aminopyrene, when fed to adult Drosophila melanogaster males, gave a negative mutagenic response in the X-linked recessive lethal assay. Benzo[a]pyrene was also ineffective in inducing "Minutes". Aflatoxin B1, EMS and DMN gave a positive response which was dependent on the concentration of mutagen fed. Whole fly homogenates prepared from adult Drosophila were assayed for mixed-function oxidase activity in the Salmonella/microsome test. Crude Drosophila microsomes activated 2-acetylaminofluorene, 2-aminofluorene, 2,7-diaminofluorene, 2-aminoanthracene, 1-aminopyrene, and aflatoxin B_1. Tests with benzo[a]pyrene, pyrene, 1,2,3,4-dibenz[a]anthracene, and 7-12 dimethylbenz[a]anthracene were negative.

41699 **Effects of copper on the sabellid polychaete, Eudistylia vancouveri. II. copper accumulation and tissue injury in the branchial crown.** Young, J.S. (Pacific Northwest Lab., Sequim, WA); Adee, R.R.; Piscopo, I.; Buschbom, R.L. *Archives of Environmental Contamination and Toxicology;* **10**: 87-104(1981). Contract EY-76-C-06-1830.

Copper in seawater caused injury to the radioles (gills) of the sabellid polychaete, Eudistylia vancouveri. Light and electron microscopy showed the loss of cellular adhesion and the structural derangement that lead to cell necrosis and death. The progression of injury was related to the uptake of copper into the tissues. Copper was found by X-ray microanalysis to be localized subcellularly in membrane-bound vesicles that are similar to lysosomes. Cell breakdown may result from lysosmal labilization.

41700 **Early appearance of histochemically altered hepatocyte foci and liver tumors in female rats treated with carcinogens one day after birth.** Peraino, C.; Staffeldt, E.F.; Ludeman, V.A. (Argonne National Lab., IL). *Carcinogenesis (New York);* **2**: No. 5, 463-465(1981). Contract W-31-109-ENG-38.

A single i.p. injection of diethylnitrosamine (DEN) or benzo[a]pyrene (BAP) in 1-day-old female rats produced a high incidence of γ-glutamyltranspeptidase-(GGT)- positive hepatocyte foci within 4 weeks after the rats were weaned onto a 0.05% phenobarbital diet; the injection of benzo[e]pyrene did not produce foci under these conditions. Liver tumors appeared in rats treated with DEN within 8 weeks after weaning and in BAP-treated rats within 16 weeks after weaning. The results suggest that the treatment protocol used in this study may increase the utility of the liver tumorigenesis model as a broadly applicable in vitro system for the rapid detection of tumorigenic potential in environmental contaminants.

41701 **Toxic and teratogenic effects of selected aromatic amines on embryos of the amphibian Xenopus laevis.** Davis, K.R. (Oak Ridge National Lab., TN); Schultz, T.W.; Dumont, J.N. *Archives of Environmental Contamination and Toxicology;* **10**: 371-391(1981). Contract W-7405-ENG-26.

Evaluations of the toxic and teratogenic effects of four aromatic amines, acridine, aniline, pyridine, and quinoline, have been made on amphibian (Xenopus laevis) embryos. For toxicity testing, the embryos were divided into three groups according to stage of development: Group I were mid-blastulae, Group II were tailbud embryos, and Group III were swimming larvae. Of the amines tested, acridine and quinoline were the most toxic, followed by aniline and pyridine. Ninety six hr LC_{50} values for acridine, quinoline, aniline, and pyridine were 4.5, 95, 150, and 1090 mg/L, respectively, for Group III larvae. Except for acridine, where embryos in all three groups were about equally affected, those in Group II were less sensitive to the other amines than those in Groups I and III. Group I embryos were exposed to all four amines to determine their teratogenicity. The amines were ranked in order of decreasing

teratogenicity. The amines were ranked in order of decreasing teratogenicity: acridine, quinoline, aniline, and pyridine having 96-hr EC_{50} values of 2.4, 29, 370, and 1200 mg/L, respectively. Electron microscopic examination of Group III larvae exposed to these amines reveals pathology of the spinal cord and musculature. This damage was correlated with immobility of the larvae. The uptake of acridine was followed in larvae (Group III) exposed to 5 mg/L and was found to reach a maximum level of about 85 mg/g wet weight in about one hr. Depuration kinetics were characterized by a rapid loss of 70% of the total acridine within 45 min. Acridine was undetectable after two hr. These data suggest that acridine, aniline, and quinoline have toxic and teratogenic effects at sufficiently low concentrations as to make them potential environmental hazards.

41702 **Enhancement of tumor formation in mouse lung by dietary butylated hydroxytoluene.** Witschi, H.P. (Oak Ridge National Lab., TN). *Toxicology;* **21**: 95-104(1981). Contract W-7405-ENG-26.

Male A/J mice were injected i.p. with a single dose of urethan and fed 0.75% butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA) or ethoxyquin in the diet. All animals were killed 4 months after urethan and the number of lung tumors counted. Exposure to BHT, but not to BHA or ethoxyquin significantly enhanced formation of lung tumors if animals were given the BHT-containing diet once a week for 8 consecutive weeks or were kept on it contiuously for 8 weeks. Prefeeding mice with BHT had no effect on tumor formation but prefeeding BHA reduced the number of tumors formed by urethan. It is concluded from this and previous work that in mouse lung BHT enhances tumor formation regardless of route of administration and over a 100-fold dose range.

41703 **Uptake of lipophilic carcinogens by plasma lipoproteins structure-activity studies.** Shu, H.P.; Nichols, A.V. (Lawrence Berkeley Lab., CA). *Biochimica et Biophysica Acta;* **665**: 376-384(1981).

This report describes the interaction between plasma lipoproteins and two hydroxylated metabolites of benzo[a]-pyrene, 3-hydroxybenzo[a]pyrene and benzo[a]pyrene-7,8-dihydrodiol, which differ significantly in lipophilicity.When incubated with plasma, the metabolites of benzo[a]pyrene exhibit a decreasing distribution into the ultracentrifugal lipoprotein fraction ($d \leqq 1.20$) and an increasing distribution into the albumin-rich fraction ($d > 1.20$) as the degree of hydroxylation of the metabolite increases. At saturation, uptake of benzo[a]pyrene by VLDL, LDL and HDL correlates with lipoprotein total-lipid volume. Uptake of hydroxylated derivatives per lipoprotein total-lipid volume, in general, decreases with increasing hydroxylation. Contrary to this trend, HDL uptake of 3-hydroxybenzo[a]pyrene at saturation is significantly higher than its uptake of benzo[a]pyrene. Uptake of benzo[a]pyrene-7,8-dihydrodiol per total-lipid volume by all of the lipoprotein classes at saturation is considerably lower than their uptake of 3-hydroxybenzo[a]pyrene. Factors in addition to lipid solubility substantially alter lipoprotein uptake of the metabolites.

41704 **Comments of softness parameters and metal ion toxicity.** Williams, M.W.; Turner, J.E. (Oak Ride National Lab., TN). *Journal of Inorganic and Nuclear Chemistry;* **43**: 1689-1691(1981). Contract W-7405-ENG-26.

A recent paper by Jones and Vaughn on the correlation of chemical softness with metal toxicity (LD_{50}) is examined. Some newer LD_{50} data are used here and several inconsistencies in the presentation of data in their paper are noted. Our observations do not alter Jones' and Vaughn's important conclusion that useful correlations appear to exist between metal toxicity and parameters that express chemical softness.

41705 **A comparison of the molecular action of an S/sub N/1-type methylating agent, methyl nitrosourea and an S/sub N/2-type methylating agent, methyl methanesulfonate, in the germ cells of male mice.** Sega, G.A.; Wolfe, K.W.; Owens, J.G. (Oak Ridge National Lab., TN). *Chemico-Biological Interactions;* **33**: 253-269(1981). Contract W-7405-ENG-26.

A study has been made of the unscheduled DNA synthesis (UDS) induced in early spermatid stages of the mouse by methly nitrosourea (MNU), a methylating agent that reacts predominantly by an S/sub N/1 type mechanism. In comparison with methyl methanesulfonate (MMS), a methylating agent that reacts predominantly by an S/sub N/2 mechanism, MNU induced more UDS by a factor of about 1.4. This result was in line with chemical dosimetry studies carried out with both chemicals, which showed that 4 after treatment with MNU, testicular DNA was methylated about 1.5 times more than it was 4 h after treatment with MMS. (JMT)

41706 **Mutagenicity and cytotoxicity of ethylene oxide in the CHO/HGPRT system.** Tan, E.L. (Univ. of Tennessee, Oak Ridge); Cumming, R.B.; Hsie, A.W. *Environmental Mutagenesis;* **3**: No. 6, 683-686(1981). Contract W-7405-ENG-26.

Ethylene oxide (EO) is made on an industrial scale (2.5 billion pounds per year) and is used not only to prepare a number of commercially important compounds but also as a widely used fumigant to sterilize foodstuffs, textiles, and medical instruments. EO is an alkylating agent that has been shown to interact with proteins and nucleic acids and is mutagenic in a number of test systems, eg, rodents, bacteria, rice, and Drosophila. Reported is the cytotoxicity and mutagenicity of EO in a mammalian cel culture system, the Chinese hamster ovary cell/hypoxanthine-guanine phosphoribosyl transferase (CHO/HGPRT) system.

41707 **Cytotoxic and mutagenic properties of shale oil by-products. I. Activation of retort process waters with near ultraviolet light.** Strniste, G.F.; Chen, D.J. (Los Alamos National Lab., NM). *Environmental Mutagenesis;* **3**: 221-231(1981).

Cultured Chinese hamster ovary (CHO) cells were exposed to dilutions of shale oil retort process waters obtained from three different retorting processes located in the Green River oil shale formations in the western part of the United States. Although the intensity of the response was dictated by the process water used, all induced a cytotoxic (reduction in colony-forming ability) and mutagenic (induced at the hypoxanthine-guanine phosphoribosyl transferase (HGPRT) locus) response in cells pretreated with dilutions of the waters and subsequent exposure to near ultraviolet light (NUV). Combinations of process water plus NUV yielded mutation frequencies as great as 50% that witnessed for the mutation frequency induced by the potent carcinogen far ultraviolet light. NUV alone was nontoxic and nonmutagenic at the doses of radiation used. Exposure of CHO cells in the dark to nontoxic dilutions of the process waters resulted in small but significant increases in 6-thioguanine resistent mutants (1-2 times background rates). The biological consequences resulting from the disposal of retort process waters into the delcate environment present in this oil shale region could be further complicated by this photoactivating process.

41708 **Cytotoxicity and mutagenicity of the fungicides captan and folpet in cultured mammalian cells (CHO/HGPRT system).** O'Neill, J.P.; Forbes, N.L; Hsie, A.W. (Oak Ridge National Lab., TN). *Environmental Mutagenesis;* **3**: 233-237(1981). Contract W-7405-ENG-26.

The cytotoxicity and mutagenicity of the fungicides captan and folpet were determined in the CHO/HGPRT system which utilizes Chinese hamster ovary cells and resistance to 6-thioguanine to estimate mutation induction at the hypoxanthine-guanine phosphoribosyl transferase locus. Treatment of cultures with each compound for 5 hr in serum-free medium resulted in reproducible, significant, concentration-dependent increases in the frequency of 6-thioguanine-resistant mutants.

41709 **Mutagenicity of coal fly ash: a new bioassay for mutagenic potential in a particle feeding ciliate.** Smith-Sonneborn, J. (Univ. of Wyoming, Laramie); Fisher, G.L.; Palizzi, R.A.; Herr, C. *Environmental Mutagenesis;* **3**: 239-252(1981). Contract AC0277EV04477.

The use of the established mutagenesis assay in Paramecium as a prescreen for hazardous environmental particles is described. Since these protozoans ingest particles of the size respired by animals and man, the biological effects of the respirable fraction of fly ash particles were monitored in particle-feeding eukaryotic cells. Fly ash from coal combustion was utilized for these studies and was found to be mutagenic. The effects of physical and chemical

treatment of the particle mutagenicity provided evidence for both heat-stable, heat-labile and acid extractable mutagenic agents.

41710 **Effects of cadmium on Drosophila: toxicity, proteins, and transfer RNAs.** Jacobson, K.B. (Oak Ridge National Lab., TN); Opresko, L.; Owenby, R.K.; Christie, N.T. *Toxicology and Applied Pharmacology;* **60**: 368-378(1981). Contract W-7405-ENG-26.

An animal model with well-defined genetic and biochemical characteristics is needed for a detailed understanding of the mechanism of toxicity by metal ions. Drosophila melanogaster was used in the present study to demonstrate a number of responses to Cd^{2+}, including lethality, age-related changes in resistance, alterations of the normal developmental changes in proteins, and alterations in specific transfer RNAs. Genotype-specific differences in resistance to Cd^{2+} were found: the v; bw strain was 5-10 times more resistant than su(s)^{3}v; bw for developmental exposure; upon treatment of the young adults the differences were in the same direction, but the sensitivities differed by only two- to three-fold. The adult fly became more sensitive to Cd^{2+} as it aged through 2 weeks, but changed little thereafter.The electrophoretic patterns of proteins of adult flies underwent changes during aging from 1 to 8 days; these changes were markedly altered by 0.55 mM $CdCl_2$ but not by 0.74 mM $ZnCl_2$ in the medium on which the flies were maintained. The appearance of queuosine-containing tRNA was stimulated by $CdCl_2$ (0.05-0.8 mM) in the growth medium, but not by $ZnCl_2$ (0.07-1.1 mM).Further studies involving D. melanogaster should be useful in defining specific interactions of toxic metal ions with macromolecules to enhance the understanding of the toxic effects of these and similar pollutants.

41711 **Inhibition of rat mammary carcinogenesis by short dietary exposure to retinyl acetate.** McCormick, D.L.; Burns, F.J.; Albert, R.E. (New York Univ., NY). *Cancer Research;* **40**: 1140-1143(Apr 1980). Contract EY-76-S-02-2737.

This study was designed to determine whether retinyl acetate was an effective inhibitor when given for short periods at the time of and after the administration of the carcinogen. Virgin female Lewis rats were given 20 mg 7,12-dimethylbenz(a)anthracene intragastrically at 50 days of age. The rats were fed Purina laboratory chow supplemented with 250 ppM retinyl acetate in groups of 20 for various lengths of time. At 30 weeks all groups receiving retinyl acetate except one showed a significant decrease in tumor multiplicity in comparison to non-retinyl acetate-treated controls. In the +1 to +12 group, the inhibition of tumor development was temporary, inasmuch as tumor values returned to control levels by Week 30. These results indicate that retinyl acetate inhibition of mammary cancer is not limited to the late stage of the disease, because the retinoid was almost equally effective when given for a short period at the time of carcinogen availability.

41712 **Comparison of toxicity and mutagenicity of methylnitrosourea, methylnitronitrosoguanidine and ICR-191 among human lymphoblast lines.** Slapikoff, S.A. (Tufts Univ., Medford, MA); Andon, B.M.; Thilly, W.G. *Mutation Research;* **70**: 365-371(1980). Contract EE-77-S-02-4267.

The toxic and mutagenic effects of the alkylating agents methylnitroscurea (MNU) and methylinitronitrosoguanidine (MNNG) and of the frameshift mutagen, ICR-191 were compared among 3 human diploid lymphoblast lines. MIT-2, WI-L2 and GM 130. The MIT-2 and WI-L2 lines wre both sensitive to the toxic and mutagenic effects of all 3 agents tested. The WI-L2 line was more sensitive to the toxic effects of MNU and MNNG than the MIT-2 line, while it was somewhat less sensitive to the mutagenic effects of these alkylating agents. The GM 130 line was strikingly resistant to both the toxic and mutagenic effects of the alkylating agents. The order of sensitivity to the toxic effect of ICR-191 was MIT-2 > WI-L2 > GM 130, while the order of sensitivity to the mutagnic effects of this frameshift mutagen was GM 130 > MIT-2 > WI-L2. These results point to the importance of accounting possible variations in mutability among individuals when extrapolating from any single mutagenicity assay for human risk assessment.

41713 **Reinterpretation of the linear nonthreshold dose-response model in terms of the initiation-promotion mouse skin tumorigenesis.** Albert, R.E.; Burns, F.J.; Altshuler, B. (New York Univ. Medical Center, NY). pp 89-95 of Advances in modern toxicology. Volume 1, Part 2. New concepts in safety evaluation. Mehlman, M.A. (ed.). Washington, DC; Hemisphere Publishing Corporation (1979).

From the standpoint of assessing cancer risks from low-level chronic exposure to environmental carcinogens, the linear nonthreshold dose-response model has been adopted at the federal regulatory level as the most plausible worst-case approach to estimating the likelihood of cancer. However, there are important uncertainties associated with the use of this model. For example, linear extrapolations from measurable levels of incidence (e.g., 10^{-1}) to levels of risk that are below the practical limits of detection imply that the individuals developing cancer at the lower level of risk or (2) the rare cancer response represents the chance occurrence of a one-hit type of process analogous to that for mutations. The purpose of this paper is to show that consideration of the initiation-promotion mouse skin tumor model suggests a view alternative to the linear dose-response model, namely, that the linear dose-response relationship refers only to the occurrence of initiated tumor foci where such foci or cells are partial neoplastic transformations that remain dormant in the skin unless advanced to an actively growing state by subsequent exposure to either a carcinogen or a promoter. By contrast the dose-response-relationships for overt tumors have the characteristics of a multi-hit process.

41714 **Induction and progression kinetics of mouse skin papillomas.** Burns, F.J.; Vanderlaan, M.; Snyder, E.; Albert, R.E. (New York Univ., NY). pp 91-96 of Carcinogenesis. Volume 2. Mechanisms of tumor promotion and cocarcinogenesis. Slaga, T.J.; Sivak, A.; Boutwell, R.K. (eds.). New York, NY; Raven Press (1978).

The papillomas that develop in mouse skin following initiation with a polycyclic hydrocarbon, such as 7,12-dimethylbenz(a)anthracene, (DMBA) and promotion with an active promoter, such as tetradecanoylphorbol acetate (TPA), have been studied extensively, and yet their significance to carcinogenesis by polycyclic hydrocarbons is not precisely known. Papillomas are focal, benign lesions consisting of folded layers of rapidly dividing cells that differentiate into squamous keratinizing cells almost as rapidly as they are produced. Such lesions may persist for many months growing slowly, others may regress, and still others may develop into invasive carcinoma. The latter papillomas are especially interesting in carcinogenesis. The present experiment was designed to determine how the various types of papillomas and their conversion to carcinoma depend on the dose of the initiating chemical and the dose and the duration of application of the promoting chemical.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 40734

41715 **(PB—82-103250) Health hazard evaluation report number HE-80-226-761 at Sundstrand Data Control, Redmond, Washington.** Apol, A.G.; Murray, W.; Parr, W. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Oct 1980. 8p. NTIS, PC A02/MF A01.

Exposure to harmful radiation was investigated at Sunstrand Data Control (SIC-3679) in Redmond, Washington, on July 24, 1980, in response to a request from the company management. Electric and magnetic radio frequency (RF) emissions from an RF heater used to preheat plastic compounds were measured. Approximately 3 to 5 workers used the RF heater work area. All radiation was below the OSHA permissible exposure of 10 milliwatts per square centimeter. A radiation leak was detected, but was easily repaired by replacement of a bolt in the heater lid. The authors concluded there was no hazard from RF exposure while using the RF heater. They recommend additional copper strip sealing at the leak area, turning off all equipment not in use, and careful maintenance.

41716 **(NASA-TM—75906) Effect of aircraft noise on the equilibrium of airport residents: longitudinal study around Roissy, Phase 3.** Francois, J. (National Aeronautics and Space Administration, Washington, DC (USA)). May 1981. Translation of Les repercussions du bruit des avions sur l'equilibre des riverains des aeroports: etude longitudinale autour de Roissy, teme phase; Inst. Francais d'Opinion Publique (IFOP), Paris, France, September 1979, pp 1-73. 104p. NTIS PC A06/MF A01.

The effects of airplane noise on the mental equilibrium of residents living near airports are discussed, and based on population sample surveys involving health questionnaires and self-administered personality tests. Progressive changes were observed on the part of residents living near a large airport.

41717 **Growth and metabolism of rodents exposed to 60-Hz electric fields.** Hilton, D.I.; Phillips, R.D. (Pacific Northwest Lab., Richland, WA). *Bioelectromagnetics (New York);* **2**: 381-389(1981). Contract EY-76-C-06-1830.

There have been a number of reports in the literature concerning growth-related changes in various animal species exposed to high-strength electric fields. Many of the laboratories reporting such effects have not documented and controlled for the secondary factors that are associated with generating high-strength electric fields (ie, corona, ozone, harmonic distortion, cage vibration, spark discharge). We have designed an exposure system in which we eliminated or minimized these secondary factors, therefore enabling us to examine only the effects of electric fields per se. Sprague-Dawley rats and Swiss-Webster mice were exposed to 60-Hz electric fields at kV/m for up to four months. In 17 individual experiments, we found a greater number of experiments in which the exposed rats had lower body weights than controls. This trend was not evident in data obtained from 14 individual mouse experiments. In more exhaustive growth studies, we found no significant differences in body weights, organ weights, or O_2 consumption between exposed and sham-exposed controls. Our failure to detect any major changes in growth was probably the result of eliminating or minimizing the secondary factors associated with electric field exposure.

41718 **Chronic exposure to a 60-Hz electric field: effects on neuromuscular function in the rat.** Jaffe, R.A.; Laszewski, B.L.; Carr, D.B. (Pacific Northwest Lab., Richland, WA). *Bioelectromagnetics (New York);* **2**: 227-239(1981). Contract AC06-76RLO1830.

Neuromuscular function in adult male rats was studied following 30 days of exposure to a 60-Hz electric field at 100 kV/m (unperturbed field strength). Isometric force transducters were attached to the tendons of the plantaris (predominantly fast twitch), and soleus (predominantly slow twitch) muscles in the urethan-anesthetized rat. Square-wave stimuli were delivered to the distal stump of the transected sciatic nerve. Several measurements were used to characterize neuromuscular function, including twitch characteristics, chronaxie, tetanic and posttetanic potentiation, and fatigue and recovery. The results from three independent series of experiments are reported. Only recovery from fatigue in slow-twitch muscles was consistently and significantly affected (enhanced) by electric-field exposure. This effect does not appear to be mediated by field-induced changes in either neuromuscular transmission, or in the contractile mechanism itself. It is suggested that the effect may be mediated secondary to an effect on mechanisms regulating muscle blood flow or metabolism.

41719 **Microwave-induced temperature, corticosterone, and thryotropin interrelationships.** Lu, S.T.; Lebda, N.; Pettit, S.; Michaelson, S.M. (Univ. of Rochester, NY). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology;* **50**: No. 2, 399-405(1981). Contract AC02-76EV03490.

To delineate acute endocrine responses to microwave energy absorption, 142 unanesthetized male Long-Evans rats acclimated to experimental procedures were subjected to far-field 2.45-GHz microwave exposure for 1 h at 1-70 mW/cm², 4 h at 0.1-40 mw/cm², or sham exposure. Controls were sham exposed in a sham-exposure chamber beginning at 030 h and killed at 1230, 1330, 1530, and 1930 h. Microwave-exposed rats were equilibrated in an anechoic chamber for 3 h prior to the start of exposure. Microwave exposure was initiated at 1130 h. Exposed rats were killed at 1230 and 1530 h. Colonic temperature (T/sub col/) was measured and serum obtained for thyrotropin (TSH) and corticosterone (CS) determination immediately after exposure. Inverse relations of TSH to power density (PD) or R/sub col/ were noted in the microwave-exposed rats while CS increased with PD or T/sub col/. Similar relations of TSH and CS to T/sub col/ were also noted among "shams." The increase of T/sub col/ by microwave exposure was dependent on PD but independent of an exposure duration greater than 1 h. The serum CS level increasd with PD but the effect decreased with duration of exposure. "Low intensity" 4-h microwave exposure inhibited normal circadian elevation of adrenocortical function in rats if the exposure was coincident with diurnal CS elevation.Inhibition of TSH became more pronounced with duration of exposure. Differences in the endocrine-body temperature relationships between sham- and microwave-exposed rats were also noted. It was concluded that endocrine control was dissociated from body temperature in the microwave-exposed rats. The endocrine control in microwave-exposed rats is different from shams.

41720 **Alterations in the rat electrocardiogram induced by stationary magnetic fields.** Gaffey, C.T.; Tenforde, T.S. (Lawrence Berkeley Lab., CA). *Bioelectromagnetics (New York);* **2**: 357-370(1981). Contract W-7405-ENG-48.

A field strength dependent increase in the amplitude of the T-wave signal in the rat electrocardiogram (ECG) was observed during exposure to homogeneous, stationary magnetic fields. For 24 adult Sprague-Dswley and Buffalo rats of both sexes, the T-wave amplitude was found to increase by an average of 408% in a 2.0 Tesla (1 Tesla = 10^4 Gauss) field. No significant magnetically induced changes were observed in other components of the ECG record, including the P wave and the QRS complex. The minimum field level at which augmentation of the T wave could be detected was 0.3 Tesla. The magnetically induced increase in T-wave amplitude occurred instantaneously, and was immediately reversible after exposure to fields as high as 2.0 Tesla. No abnormalities in any component of the ECG record, including the T wave, were noted during a period of 3 weeks following cessation of a continuous 5-h exposure of rats to a 1.5-Tesla field. The heart rate and breathing rate of adult rats were not altered during, or subsequent to, application of fields up to 2.0 Tesla. The effect of animal orientation within the field was tested using juvenile rats 3-14 days old. The maximum increase in T-wave amplitude was observed when subjects were placed with the long axis of the body perpendicular to the lines of magnetic induction. (JMT)

41721 **Der einfluss von mikrowellen auf veraenderungen in lebensmitteln im vergleich zur konventionellen. Hitzebehandlung eine literaturstudie. Teil III. (Effect of microwaves on changes in foods in comparison to conventional heating. A literature review. Part III).** Rutz-Meyer, B.; Boegl, W. Berlin, Germany; Dietrich Reimer Verlag (1981). 309p. (STH—8/1981). Dietrich Reimer Verlag, Unter den Eichen 57, 1000 Berlin 45, Germany.

Portions of document are illegible.

In Part III of the Present study of relevant literature, 35 experimental studies from 6 countries published on the effects of microwaves on foodstuffs and food ingredients are reviewed and evaluated. The purpose is to contribute to the discussion of, and to answer the question, whether changes are caused by microwave treatment of foodstuffs which differ from those caused by conventional heating. There is no indication of radiation-specific effects, i.e., athermic effects, of microwaves contained in any of the studies reviewed up to now.

41722 **Chronic exposure to 60-Hz electric fields: effects on pineal function in the rat.** Wilson, B.W.; Anderson, L.E.; Hilton, D.I.; Philips, R.D. (Pacific Northwest Lab., Richland, WA). *Bioelectromagnetics (New York);* **2**: 371-380(1980). Contract ACO6-76RLO 1830.

As a component of studies to search for effects of 60-Hz electric field exposure on mammalian endocrine function, concentrations of melatonin, 5-methoxytryptophol, and serotonin-N-acetyl transferase activity were measured in the pineal glands of rats exposed or sham-exposed at 65 kV/m for 30 days.In two replicate ex-

periments there were statistically significant differences between exposed and control rats in that the normal nocturnal increase in pineal melatonin content was depressed in the exposed animals. Concentrations of 5-methoxytryptophol were increased in the pineal glands of the exposed groups when compared to sham-exposed controls. An alteration was also observed in serotonin-N-acetyl transferase activity, with lower levels measured in pineal glands from exposed animals.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 40717, 41427, 41458, 41715

41723 Role of independent inspection in verification activities. Fuerste, W. (Rheinisch-Westfaelischer Technischer Ueberwachungs-Verein e.V., Essen (Germany, F.R.)). pp 191-214 of Quality assurance for nuclear power plants. Proceedings of an international symposium organized by the IAEA and held in Paris, 11-15 May 1981. Vienna, Austria; IAEA (1982).

From International symposium on quality assurance for nuclear power plants; Paris, France (11 May 1981).

Independent inspection has its origin in the early Middle Ages, when kings prescribed to textile manufacturers a quality control by authorized inspectors. Independent inspection became more important with respect to the safety of workers in the industrial era beginning in the 18th century, when the high-pressure steam engines were introduced and many accidents and explosions of steam boilers occurred. Nowadays, independent inspection is of utmost importance, because the safety of the public is endangered by industrial plants located near highly populated areas. To better understand the role of independent inspection, the paper reviews its historical development in Europe from the Middle Ages to the 20th century. Most of the independent inspection associations in European countries were established after the second half of the 19th century and began with the surveillance of steam boilers. Nowadays, organizations like the TUEVs (Technical Inspection Agencies) in the Federal Republic of Germany perform expertise and inspection on behalf of the government in various fields of industrial safety. To show how independent inspection is involved in quality assurance, the methods practised in the United States of America and the Federal Republic of Germany are compared and future trends discussed. For developing countries starting with nuclear energy, it is important to consider the information and recommendations regarding independent inspection and its regulation as laid down in a number of publications in the IAEA NUSS Programme.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 40285, 40286, 40293, 40824, 41433, 41437

41724 (ENPU—80-6) Preliminary account of the hydrogeology of Altnabreac, Caithness. Glendining, S.J. (Institute of Geological Sciences, Harwell (UK). Environmental Protection Unit). Apr 1980. 28p. Environmental Protection Unit, Institure of Geological Sciences, Building 151, Harwell Laboratory, Oxfordshire OX11 ORA, England.

Using standard hydrogeological techniques a model of shallow ground water movement at Altnabreac has been derived. Investigations into the deep hydrogeology and its interrelationship with shallow groundwater movement, will be described in subsequent reports. The topography, drainage and geology provide a physical basis for the discussion of the hydrogeology. Using meteorological and hydrological data together with the results of borehole investigations, values for storativity, hydraulic conductivity, hydraulic gradients and bulk velocities were determined. A flow net was constructed describing flow patterns in the area. The methods of deriving these properties and the model are presented and their limitations discussed.

41725 (LBL—13904) Geochemical anomalies near the Eocene-Oligocene and Permian-Triassic boundaries. Asaro, F.; Alvarez, L.W.; Alvarez, W.; Michel, H.V. (Lawrence Berkeley Lab., CA (USA)). Oct 1981. Contract W-7405-ENG-48. 37p. (CONF-8110141—2). NTIS, PC A03/MF A01. Order Number DE82011145.

From Conference on large body impacts and terrestrial evolution; Snowbird, UT, USA (18 Oct 1981).

Evidence is presented to support the theory that several mass extinctions, i.e., those that define the Permian-Triassic boundary, the Cretaceous-Tertiary boundary, and the Eocene-1 Oligocene boundary, were caused by impact on the earth of extraterrestrial objects having the composition of carbonaceous chondrites and diameters of about 10 km. The evidence consists of anomalously high concentrations of iridium and other siderophile elements at the stratigraphic levels defining the extinctions. (ACR)

41726 (NP—2904121) Guidebook to the geology and ore deposits of the St. Francois Mountains, Missouri. Kisvarsanyi, E.B.; Hebrank, A.W.; Ryan, R.F. (Missouri Dept. of Natural Resources, Rolla (USA). Div. of Geology and Land Survey). 1981. 120p. Wallace B. Howe, Director and State Geologist, Geology and Land Survey, Dept. of Natural Resources, Buehler Park, P.O. Box 250, Rolla, MO 65401 $4.00.

The St. Francois Mountains constitute the exposed portion of an extensive Precambrian terrane of anorgenic, granitic ring complexes identified on the basis of drillhole data and aeromagnetic maps. The terrane is characterized by the predominance of alkaline-silicic over mafic rocks, and trachytic intermediate rocks. The distinctive ore deposits are (1) magmatic and hydrothermal iron - apatite deposits (Kiruna type); (2) hypo-exothermal vein deposits of tungsten, silver and lead; and (3) vein and replacement deposits of manganese. This guidebook presents routes featuring the principal rock types and provides an opportunity to study the only extensive outcrops of Precambrian rocks in the continental interior of the US. (ACR)

41727 (PNL—4005) Assessment of effectiveness of geologic isolation systems. Analytic modeling of flow in a permeable fissured medium. Strack, O.D.L. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1982. Contract AC06-76RL01830. 117p. NTIS, PC A06/MF A01. Order Number DE82009289.

An analytic model has been developed for two dimensional steady flow through infinite fissured porous media, and is implemented in a computer program. The model is the first, and major, step toward the development of a model with finite boundaries, intended for use as a tool for numerical experiments. These experiments may serve to verify some of the simplifying assumptions made in continuum models and to gain insight in the mechanics of the flow. The model is formulated in terms of complex variables and the analytic functions presented are closed-form expressions obtained from singular Cauchy integrals. An exact solution is given for the case of a single crack in an infinite porous medium. The exact solution is compared with the result obtained by the use of an independent method, which assumes Darcian flow in the crack and models the crack as an inhomogeneity in the permeability, in order to verify the simplifying assumptions. The approximate model is compared with solutions obtained from the above independent method for some cases of intersecting cracks. The agreement is good, provided that a sufficient number of elements are used to model the cracks.

41728 (UCRL—53231) Dating fault-associated Quaternary material from the Nevada Test Site using uranium-series methods. Knauss, K.G. (Lawrence Livermore National Lab., CA (USA)). Sep 1981. Contract W-7405-ENG-48. 55p. NTIS, PC A04/MF A01. Order Number DE82009018.

Accumulations of secondary carbonate in the arid southern Great Basin are frequently associated with or disturbed by Basin and Range faults. In appropriate situations, these materials may be dated by uranium-series disequilibrium techniques using a combined chemical-leach and graphical correction procedure to account for included detrital material. The dates provide a minimum, a maxi-

mum, or a bracket of ages for tectonic activity on the faults investigated. Carbonates (e.g., travertine, calcrete, and caliche) were dated from the Carpetbag, Yucca, Boundary, and Cane Spring Faults at the Nevada Test Site. Multiple ages obtained from the same fault were always in correct relative order where stratigraphic relationships were known. Many of the ages obtained agree with age estimates based on geomorphology. A bracket of ages obtained for three samples from the Carpetbag Fault suggest that the last natural movement occurred more than 37,000 but less than 93,000 yr ago. A maximum age of 35,000 yr is obtained for natural movement on the Yucca Fault. A total of six repeatedly disturbed carbonate samples could provide only an obviously high maximum age of 217,000 yr for movement on the Boundary Fault. Tufaceous travertines from the Cane Spring Fault and a related normal fault suggest a probable low-minimum age of 41,000 yr for the last movement. Initial attempts were made to determine the potential for age dating fault zone secondary silica using uranium-series disequilibrium techniques. The old ages obtained (≧ 700,000 yr) support the contention that most Quaternary tectonism has been restricted to areas of recent subsidence, the deep alluvial basins. These results also validate recent attempts to determine U-Pb ages for uraniferous opals.

5802 Geophysics

REFER ALSO TO CITATION(S) 40293, 40304, 40657

41729 **(CONF-820140—1) Computer-based system for processing geophysical data obtained from boreholes.** Richter, J.M. (EG and G, Inc., San Ramon, CA (USA). Energy Measurements Group). 1982. Contract AC08-76NV01183. 26p. NTIS, PC A03/MF A01. Order Number DE82008543.

From 1. annual conference on management, analysis and display of geoscience data; Golden, CO, USA (27 Jan 1982).

A diverse set of computer programs has been developed at the Lawrence Livermore National Laboratory (LLNL) to process geophysical data obtained from boreholes. These programs support such services as digitizing analog records, reading and processing raw data, cataloging and storing processed data, retrieving selected data for analysis, and generating data plots on several different devices. A variety of geophysical data types are accommodated, including both wireline logs and laboratory analyses of downhole samples. Many processing tasks are handled by means of a single, flexible, general-purpose data-manipulation program. Separate programs are available for processing data from density, gravity, velocity, and epithermal neutron logs.

41730 **(ENPU—80-3) Reconnaissance geophysical surveys at Altnabreac, Caithness.** Lee, M.K.; Richards, M.L. (Institute of Geological Sciences, London (UK). Applied Geophysics Unit). Apr 1980. 17p. Environmental Protecton Unit, Building 151, Harwell Laboratory, Oxfordshire, OX11 ORA, England.

Portions of document are illegible.

This report outlines the results of the first stage geophysical support studies for the Altnabreac drilling research program. This initial work involved reconnaisance magnetic, VLF-EM and resistivity surveys. The results suggest that the magnetic method can be used to map occurrences of diorite within the granite and that the VLF-EM method may help to define faulted or mineralized zones. Resistivity depth soundings were not about to define the thickness of the superficial (peat, drift and weathered granite) layers to the required accuracy. Details of the main phase surface geophysical investigations will appear in subsequent reports.

41731 **(ENPU—80-15) Regional setting of the Strath Halladale Granite from gravity and aeromagnetic data.** Lee, M.K. (Institute of Geological Sciences, London (UK). Applied Geophysics Unit). Dec 1980. 35p. Environmental Protecton Unit, Building 151, Harwell Laboratory, Oxfordshire, OX11 ORA, England.

Regional gravity and aeromagnetic data have been used to investigate the structural setting of the Strath Halladale Granite and surrounding area. The granite body is characterized by a distinctive magnetic anomaly pattern which contrasts sharply with those over the magnetic Moine metasediments to the west and the non-magnetic Moine rocks and Old Red Sandstone sediments to the east. The Bouguer Gravity Anomaly map is dominated by a strong regional gradient which has been removed to reveal a small but distinctive negative residual gravity anomaly over the granite. Two-dimensional gravity and magnetic interpretations have been carried out along two sections across the granite and a limited three dimensional gravity interpretation has been attempted around the Altnabreac research site. The interpretations indicate that density and susceptibility contrasts associated with the granite extend to a depth of between 3 and 4 km, and that low density granitic rocks extend at shallow depth several km east of the mapped contact at Altnabreac.

41732 **(NUREG/CR—2131) New England seismotectonic study: activities during fiscal year 1979.** Barosh, P.J. (Weston Observatory, MA (USA)). Sep 1981. 229p. NTIS, PC A11/MF A01.

This report summarizes the fourth of a six year program to investigate causes of seismicity in New England and adjacent areas. The program provides regional geologic, geophysical and seismic information needed to assess seismic activity in the area, to delinate seismotectonic provinces and relate structure to seismicity.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 40294, 40301, 40303, 40307, 41224

41733 **(ENPU—80-11) Fracture analysis of crystalline rocks: field measurements and field geomechanical techniques.** McEwen, T.J. (Institute of Geological Sciences, Harwell (UK). Environmental Protection Unit). Jul 1980. 75p. Environmental Protection Unit, Institure of Geological Sciences, Building 151, Harwell Laboratory, Oxfordshire OX11 ORA, England.

The natural fractures occurring in crystalline rocks are described in terms of their occurrence in granite masses and in metamorphic rocks. Their orientations are shown to be related to the paleo or present stresses which acted or act on the rocks, to the tectonic setting of the rock mass, and in some cases to any igneous banding that might exist. The analysis of fractures in surface outcrops and in boreholes is discussed in detail, and it is shown how estimates of fracture length, fracture area and fracture interconnectivity can be made from relatively simple measurements. The biases inevitably incurred during sampling are discussed in terms of their influence on the analyzed data, and methods for compensating for their effects are also included. The influence of the fracture surfaces on the mechanical properties of rock masses is described, and methods for measuring the shear strengths of fracture surfaces is discussed. The importance of the shear strength of rocks is analyzed in terms of their effects on determining the development of the fracture system. Finally the use of fracture orientations to determine the geotectonic stress field is discussed with examples from different tectonic environments. This report is in no sense a complete literature review of all available information on fractures in rocks and their influence on the response of rock masses to applied stresses and on its hydrogeological properties. It is designed to illustrate the types of analysis which area available for studying fractured rock, and which are specifically relevant to the programme of research into the feasibility of the disposal of high level radioactive waste in geological formations.

41734 **CANMET'S rock-mechanics research at the Kidd Creek Mine.** Hedley, D.G.F.; Herget, G.; Miles, P.; Yu, Y.S. Hull, Quebec; Canadian Government Publishing Centre (1979). 52p. (CANMET—79-11). CANMET, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Canada K1A 0G1.

Portions of document are illegible.

The Kidd Creek mine of Texasgulf Metals Company started as an open pit and later converted to an underground operation. In 1972, a cooperative rock mechanics research project was initiated between the company and the Mining Research Laboratories of CANMET. Research was concerned with stability of the hanging wall pit slope as it was undercut by the underground operations and with ground control aspects of the blasthole open stoping method employed underground. Geotechnical investigations on

critical joint orientations and shear resistance along these discontinuities indicated that a plane or rotational shear type of instability of the hanging wall slope was unlikely. This was confirmed by two- and three-dimensional finite element models, although sloughing of the hanging wall shear zone was predicted. During the time these studies were being done, stopes were being blasted through at the southern end while the pit was being deepened at the northern end. No instability of the pit walls interrupted either operation and the pit was completed in 1977. Underground, field stress measurements were taken down to a depth of 850 m, indicating that the stress regime was similar to that in other mines in northern Ontario with horizontal stresses being greater than vertical stresses. Deformation measurement around underground stopes showed that expansion of the footwall shear zone was ten times greater than the pillar wall. A preliminary analysis on pillar stability suggested that stresses on the pillar edge and corners could be of the same magnitude as pillar strength. This could explain the cases of pillar sloughing, but adverse structural geology could also have caused this sloughing.

5804 Geochemistry

REFER ALSO TO CITATION(S) 40293

5805 Oceanography

REFER ALSO TO CITATION(S) 41433

64 PHYSICS RESEARCH

6401 Astrophysics And Cosmology

41735 **(AD-A—097734/8) Techniques for the simulation of the space plasma environment.** Halverson, W.D. (Spire Corp., Bedford, MA (USA)). Sep 1980. 46p. NTIS PC A03/MF A01.

The effects of space plasmas with distributed spectra of particle energies can be simulated in the laboratory by combinations of monoenergetic electron and ion beams. The energy and current density of beams are calculated to provide piecewise reproduction of distributed spectra and by matching various moments of the velocity distribution functions of space plasmas. Analytical solutions for several cases have been found to simulate Maxwellian and two-Maxwellian distribution functions. Spacecraft charging by geomagnetic substorm plasmas and combinations of monoenergetic beams is compared qualitatively using a simple model. We find similar charging characteristics for the plasmas and a few beams specified by the moment matching techniques.

41736 **(AD-A—098041/7) Tropospheric - stratospheric tidal investigations. Part I. Hough components of water vapour heating. Final scientific report, 1 December 1976-30 April 1981.** Groves, G.V. (University Coll., London (UK). Dept. of Physics and Astronomy). 31 Dec 1980. 73p. NTIS PC A04/MF A01.

Formulae are derived for the Hough components and mean rate of insolational heating by water vapour absorption in an atmosphere with cloud-related scattering properties. Global models of specific humidity and cloud amount are adopted for the months of January, April, July, and October and used in conjunction with adopted values of surface albedo, absorption coefficients and scattering parameters to evaluate diurnal and semi-diurnal components of heating for migrating modes. The inclusion of cloud scattering has the notable effect of nearly doubling heating rates at 8 km altitude and of halving values near the surface. A number of non-migrating components associated with the principal diurnal and semi-diurnal modes have also been evaluated.

41737 **(AD-A—102891/9) Objective method for forecasting solar flares. Environmental research papers.** Neidig, D.F.; Wiborg, P.H.; Seagraves, P.H.; Hirman, J.W.; Flowers, W.E. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 4 Feb 1981. 28p. (AFGL-TR—81-0026; AFGL-ERP—726). NTIS, PC A03/MF A01.

Solar parameters derived from the region analysis program at the NOAA Space Environment Services Center (SESC) are submitted to a multivariate discriminant analysis (MVDA) in which the parameters relevant to flare prediction are identified and incorporated in a classification procedure to produce a flare forecast. The analysis uses two years of data (6095 solar active region-days). The MVDA forecast is compared with a subjective forecast derived from the SESC forecast during the same period, and is found to have greater accuracy overall. Specific recommendations are made concerning the application of the technique in a forecasting operation, and in the types of data required for future improvement.

41738 **(AD-A—103026/1) Magnetic energy storage and conversion in the solar atmosphere. Memorandum report.** Spicer, D.S. (Naval Research Lab., Washington, DC (USA)). 1 Jul 1981. 80p. (NRL-MR—4550). NTIS, PC A05/MF A01.

A review of the theoretical problems associated with preflare magnetic energy storage and conversion is presented. The review consists of three parts; preflare magnetic energy storage, magnetic energy conversion mechanisms, and preflare triggers. The relationship between magnetic energy storage and the electrodynamic coupling of the solar atmosphere is developed. By accounting for the electrodynamic coupling of the solar atmosphere, one is able to examine the fundamental problems associated with the concept of in situ versus remote magnetic-energy storage. Furthermore, this approach permits us to distinguish between the roles of local and global parameters in the storage process. The conversion mechanisms are discussed that can explain, in principle, the rapid energy release of a flare. In addition, it is discussed, how electrodynamic coupling eventually dictates which mechanism(s) is responsible for releasing the stored magnetic energy, and how the global coupling dictates the final evolution of the relevant mechanism. Section 4 examines preflare triggers and the most promising directions for future research into the problem of magnetic-energy storage and conversion of the sun are examined.

41739 **(BMFT-FB-W—79-40) Temperature distribution and dynamics of interplanetary dust particles in the vicinity of the sun (solar probe Helios A and B: experiment 10 Z). Final report.** Schewhm, G.H. (Ruhr-Univ., Bochum (Germany, F.R.)). Jun 1980. 109p. (In Several languages). NTIS, PC A06/MF A01.

The sublimation of interplanetary dust grains in the vicinity of the Sun was considered, especially as a possible source of beta meteoroids. Data from the HELIOS 1 and 2 micrometeoroid detectors (E 10) were interpreted. To determine the sublimation rates, the energy balance of a grain was evaluated for interaction with the solar radiation field, with solar wind particles, and with solar energetic particles. Compared to the energy transfered through interaction with the solar radiation field, all other processes were negligible for the determination of the temperature distribution. The only exception was water ice particles. The equation of motion for the dust particles was numerically solved with regard to the forces of interaction with the solar electromagnetic radiation field. Depending on the material and sizes, the orbits of the particles stabilize at different heliocentric distances. The inward spiraling due to the Poynting-Robertson effect ends by the total evaporation of the particles in the stability region.

41740 **(INPE—1940-RPE/259) Solar wind energy and electric field transfer to the earth's magnetosphere via magnetopause reconnection.** Gonzalez, A.W.D.; Degonzalez, A.L.C. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Nov 1980. 16p. NTIS, PC A02/MF A01.

Some general expression for the convection and parallel electric fields as well as for the energy transfer, due to magnetopause reconnection, are derived using a nose reconnection model that takes into account the presence of the clefts. For the case of equal geomagnetic and magnetosheath field amplitudes, the expression for the power dissipated by the convection electric field reduces to the substorm parameter epsilon. This suggests that magnetopause reconnection is defined at the nose with a tilted reconnection line, but that the convection electric field is related only to the

dawn dusk component of the reconnection electric field, as defined at high latitudes (clefts).

41741 **(INPE—1958-RPE/272) Mm-wave and x-ray observations of a Cen-a flare.** Kaufmann, P./ Strauss, F.M. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Dec 1980. 7p. NTIS, PC A02/MF A01.

A short-term series of daily observations of Cen A obtained at 13.5 mm wavelength is reported which displays a distinctive rise-and-fall flare. Corresponding data obtained in the low energy X-ray range (4-10 keV) are also presented. Observations covered the period 4-25 December 1979, and were obtained at Itapetinga Radio Observatory and Ariel 5 satellite.

41742 **(MPI-PAE/EXTRATERR—162) High resolution x-ray spectroscopy and solar heliography from rockets.** Haerle, H.R. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Astrophysik). Mar 1980. 156p. (In German). NTIS, PC A08/MF A01.

Data obtained for line emissions of high ion atom activity areas in the disturbed corona, with the same origins, the diminishing physical processes and the correlation processes for certain condition parameters were compared with models from interference areas. Three different camera techniques were employed. Theoretical spectra of a hot plasma produced by the corona were computed based on results from initial experiments. It was found that the small band X-ray photography method is better for detailed investigation of coronal structures than the X-ray spectroscopy method.

41743 **(NASA-CR—161644) Simulation of the magnetic structure of the inner heliosphere by means of non-spherical source surface.** Levine, R.H.; Schulz, M. (Aerospace Corp., El Segundo, CA (USA)). Jan 1981. 59p. NTIS, PC A04/MF A01.

A new method for mapping the Sun's magnetic field B from the photosphere through the corona and interplanetary space is presented. The method entails the derivation of B from a scalar potential within a current-free annular volume bounded inside by photosphere and outside by a prescribed nonspherical source surface to which B is made (as nearly as possible) perpendicular. As usual we obtain the potential for the part of B that arises from currents inside the Sun by fitting an expansion to the observed line-of-sight component of B at the photosphere. A second least-squares fit is introduced to obtain the part of B that arises from currents outside the source surface. Comparisons are made between this model and observed coronal and interplanetary structures. There is evidence that observation data underestimate the strength of photospheric polar magnetic fields.

41744 **(NASA-CR—163966) Plasma waves near Saturn: initial results from Voyager 1.** Gurnett, D.A.; Kurth, W.S.; Scarf, F.L. (Iowa Univ., Iowa City (USA)). Jan 1981. 30p. NTIS, PC A03/MF A01.

The Voyager 1 encounter with Saturn provided the first opportunity to investigate plasma wave interactions in the magnetosphere of Saturn. An overview of the principal results from the Voyager 1 plasma wave instrument is presented starting with the initial detection of Saturn and ending about four weeks after closest approach. A survey plot of the electric field intensities detected during the Saturn encounter is shown starting shortly before the inbound shock crossing and ending shortly after the outbound magnetopause crossing. Many intense waves were observed in the vicinity of Saturn. To provide a framework for presenting the observations, the results are discussed more or less according to the sequence in which the data were obtained.

41745 **(NASA-CR—164000) Deceleration of the solar wind in the earth foreshock region: ISEE 2 and IMP 8 observations.** Bonifazi, C.; Moreno, G. (Comitato Nazionale per le Scienze Fisiche, Frascati (Italy). Lab. di Ricerca e Tecnologia per lo Studio del Plasma nello Spazio). Jan 1980. 28p. NTIS, PC A03/MF A01.

The deceleration of the solar wind in the region of the interplanetary space filled by ions backstreaming from the Earth bow shock was studied using a two spacecraft technique. This deceleration, which is correlated with the diffuse but not with the reflected ion population, depends on the solar wind bulk velocity: at low velocities (below 300 km/sec) the velocity decrease is about 5 km/sec, while at higher velocities (above 400 km/sec) the decrease may be as large as 30 km/sec. Along with this deceleration, the solar wind undergoes a deflection of about 1 deg away from the direction of the Earth bow shock. The energy balance shows that the kinetic energy loss far exceeds the thermal energy which is possibly gained by the solar wind, therefore, at least part of this energy must go into waves and/or into the backstreaming ions.

41746 **(NASA-CR—164013) A balloon measurement of the isotopic composition of galactic cosmic ray boron, carbon and nitrogen.** Zumberge, J.F. (California Inst. of Tech., Pasadena (USA)). 1981. 129p. NTIS, PC A07/MF A01.

The isotopic compositions of galactic cosmic ray boron, carbon, and nitrogen were measured at energies near 300 MeV amu, using a balloon-borne instrument at an atmospheric depth of approximately 5 g/sq cm. The calibrations of the detectors comprising the instrument are described. The saturation properties of the cesium iodide scintillators used for measurement of particle energy are studied in the context of analyzing the data for mass. The achieved rms mass resolution varies from approximately 0.3 amu at boron to approximately 0.5 amu at nitrogen, consistent with a theoretical analysis of the contributing factors. Corrected for detector interactions and the effects of the residual atmosphere the results are B-10/B 0.33 (+0.17, -0.11), C-13/C 0.06 (+0.13, -0.11), and N-15/N 0.42 (+0.19, -0.17). A model of galactic propagation and solar modulation is described. Assuming a cosmic ray source composition of solar-like isotopic abundances, the model predicts abundances near Earth consistent with the measurements.

41747 **(NASA-CR—164031) Impulsive phase of solar flares. 1: characteristics of high energy electrons.** Leach, J.; Petrosian, V. (Stanford Univ., CA (USA)). Mar 1981. 49p. NTIS, PC A03/MF A01.

The variation along a magnetic field line of the energy and pitch angle distribution of high energy electrons injected into a cold hydrogen plasma containing either an open or closed magnetic field structure was investigated. The problem is formulated as a time independent Fokker-Planck Equation for the electron number distribution as a function of the electron energy, electron pitch angle, and the structure of the global magnetic field. Simple analytic solution valid in the small pitch angle regime and for slowly varying magnetic field is presented. For the more general situation a numerical code for solving the Fokker-Planck Equation was used and it was found that the analytic expression agrees well with the numerical results to values of the pitch angle much larger than expected. For most practical applications, one many confidently use the analytic expression instead of having to resort to lengthy numerical computations. These results are useful in the study of the nonthermal models of the impulsive phase of solar flares.

41748 **(NASA-CR—164040) A comparison of the height distributions of solar flare hard x-rays in thick target and thermal models.** Emslie, A.G. (Stanford Univ., CA (USA)). Oct 1980. 32p. NTIS, PC A03/MF A01.

The height structure of hard X-ray bremsstrahlung emission in solar flares is computed for two different models of bremsstrahlung production: emission from a descending beam of nonthermal electrons, and thermal emission from a coronally confined hot plasma. It is shown how these models give rise to hard X-ray spatial distributions which are distinguishable by current instrumentation, and that, therefore, the models may be distinguished by such spatially resolved hard X-ray measurements.

41749 **(NASA-CR—164041) Discrepancies between empirical and theoretical models of the flaring solar chromosphere and their possible resolution.** Emslie, G.A.; Brown, J.C. (Stanford Univ., CA (USA)). Aug 1980. 27p. NTIS, PC A03/MF A01.

Models of the solar chromosphere during flaring deduced theoretically or empirically are compared. Marked discrepancies are noted and various reasons are offered to explain their existence. A means is presented for testing theoretical heating models (electron heating) by analyzing the net energy loss rates in (observed)

empirical atmospheres and inverting the flare energy equation to deduce the parameters of the supposed heating mechanism.

41750 (NASA-CR—164061) **Elemental composition of solar energetic particles.** Cook, W.R., III. (California Inst. of Tech., Pasadena (USA)). 1981. 183p. NTIS, PC A09/MF A01.

The Low Energy Telescopes on the Voyager spacecraft are used to measure the elemental composition (2 or Z or 28) and energy spectra (5 to 15 MeV/nucleon) of solar energetic particles (SEPs) in seven large flare events. Four flare events are selected which have SEP abundance ratios approximately independent of energy/nucleon. The abundances for these events are compared from flare to flare and are compared to solar abundances from other sources: spectroscopy of the photosphere and corona, and solar wind measurements. The four flare average SEP composition is significantly different from the solar composition determined by photospheric spectroscopy. The average SEP composition is in agreement with solar wind abundance results and with a number of recent coronal abundance measurements. The evidence for a common depletion of oxygen in SEPs, the corona and the solar wind relative to the photosphere suggest that the SEPs originate in the corona and that both the SEPs and solar wind sample a coronal composition which is significantly and persistently different from that of the photosphere.

41751 (NASA-CR—164141) **Continued analysis of OSO-8 and Kitt peak data on solar faculae.** Chapman, G.A. (California State Univ., Northridge (USA)). Apr 1981. 125p. NTIS, PC A06/MF A01.

An improved semi-empirical model of photospheric faculae is presented in tabular form. The limitations of the model as well as other possible improvements are discussed.

41752 (NASA-CR—164344) **NASA contributions to the 17th international conference on cosmic rays.** (Maryland Univ., College Park (USA)). 1981. 28p. NTIS, PC A03/MF A01.

Charged particle events occurring in solar flares are discussed, with emphasis on heavy ion abundances, particle acceleration and particle transport.

41753 (NASA-CR—164344, pp 1-4) **Observations of interplanetary energetic charged particles from gamma-ray line solar flares.** Pesses, M.E. (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, West Germany); Klecker, B. (Max-Planck-Inst. fuer extraterresrische Physik, Garching, West Germany). 1981. NTIS, PC A03/MF A01.

In NASA contributions to the 17th international conference on cosmic rays.

Observations of interplanetary energetic ions from the 7 June, 21 June and 1 July 1980 gamma ray line solar flares are presented. The observations are from the Max-Planck-Institut/University of Maryland Ultra Low Energy Wide Angle Telescope aboard the ISEE-3 spacecraft. Both June flares produced relatively low intensity proton events at earth with peak intensities at 10-20 MeV approximately 5 x .01 protons square cm sec sr MeV)-1. Neither flare showed evidence of being enriched in either 3He or Fe at approximately 1 MeV/nucleon. The 1 July flare produced no observable ion or electron enhancements.

41754 (NASA-CR—164344, pp 5-8) **Time and energy dependence of heavy ion abundances in solar flare energetic particle events.** Mason, G.M.; Weiss, H.; Gloeckler, G.; Hovestadt, D. 1981. NTIS, PC A03/MF A01.

In NASA contributions to the 17th international conference on cosmic rays.

Examples are presented of the time and energy dependence of the abundances and spectra of the major heavy ions He, C, O and Fe during solar flare events, taken from a survey using the UMD/MPI ULET telescope on IMP-8 during 1973-1977. In some cases, time variations were found in the O/He, O/C and Fe/O ratios which appear to be inconsistent with models based solely on rigidity dependent propagation in the interplanetary medium.

41755 (NASA-CR—164344, pp 10-13) **Observations of the ionization states of energetic particles acceleratedin solar flares.** Gloeckler, G. (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching); Weiss, H. (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching); Hovestadt, D. (New Hampshire Univ.); Ipavich, F.M. (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching); Klecker, B. (Ariz. Univ.); Fisk, L.A. (Chicago Univ.). 1981. NTIS, PC A03/MF A01.

In NASA contributions to the 17th international conference on cosmic rays.

Results of a survey of ten solar flare particle events, in which the ionization states and spectra of 0.3 to 2.4 MeV/nuc He, C, O and Fe were measured, are reported. He+ was present in all events (He+/He++ approximately 0.1 to 0.25), and the mean ionization states of C, O and Fe are high. The distribution functions of He+, He++ and heavier elements are well represented by simple exponentials of the particle speed times its rigidity to a power n, where n is between O and 1, and equal e-folding values. Results are consistent with a model whereby ions are accelerated in the corona by multi-dimensional shocks out of a population taken from both hot and cold coronal regions.

41756 (NASA-CR—164344, pp 14) **Evolution of the energetic particle composition during solar flare events as observed by Voyager 1 and 2.** Hamilton, D.C.; Gloeckler, G. 1981. NTIS, PC A03/MF A01.

In NASA contributions to the 17th international conference on cosmic rays.

Measurements of the composition and energy spectra of the energetic ions from two solar flare particle events are presented. Their evolution with time during each event is discussed. The data are from the Low Energy Particle Telescope (LEPT) on Voyager 2, which can identify the major ion species (Z 1-26) over an energy range of approximately 0.5-50 MeV/nucleon.

41757 (NASA-CR—164344, pp 15-18) **On the anticorrelation between the He-3;He-4 ratio and proton intensity in He-3 rich flares.** Pesses, M.E. 1981. NTIS, PC A03/MF A01.

In NASA contributions to the 17th international conference on cosmic rays.

A model is presented which can explain the observed anticorrelation between the size of the 3He/4He abundance ratio at greater than or approximately 10 MeV/nuc and the peak intensity of approximately 10 MeV protons in 3He rich events. If 3He is preaccelerated with respect to 4He prior to the main ion acceleration phase, and if the main ion acceleration phase has an effective injection cutoff which varies from flare to flare, the observed anticorrelation follows naturally.

41758 (NASA-CR—164344, pp 19-22) **Analytical description of charged particles transport along arbitrary guiding-field configurations.** Earl, J.A. 1981. NTIS, PC A03/MF A01.

In NASA contributions to the 17th international conference on cosmic rays.

A new description of focused transport was developed which is valid for arbitrary spatial dependences of both the scattering mean free path and the focusing length. In particular, it describes the supercoherent transition from the coherent mode that occurs when focusing is strong compared to scattering to the diffusive mode that occurs when focusing is weak. Because it specifies the pitch angle distribution in terms of relatively simple functions, the new formulation facilitates not only the detailed interpretation of solar particle events, but also the qualitative understanding of focused transport. In the steady state, it predicts that the angular distribution consists of a highly collimated 'strahl' which is superimposed on an anisotropic 'halo'. This picture provides new insight into observed configurations of steady-state particle fluxes.

41759 (NASA-CR—164344, pp 23-26) **A supra-thermal energetic particle detector (STEP) for composition measurements in the range approximately 20 keV/nucleon to 1 MeV/nucleon.** Mason, G.M.; Gloeckler, G. 1981. NTIS, PC A03/MF A01.

In NASA contributions to the 17th international conference on cosmic rays.

A detector system is described, employing a time-of-flight versus residual energy technique which allows measurement of particle composition (H-Fe), energy spectral and anisotropies in an energy range unaccessible with previously flown sensors. Applications of this method to measurements of the solar wind ion composition are discussed.

41760 (NASA-CR—164345) **Cosmic ray drift, shock wave acceleration and the anomalous component of cosmic rays.** Pesses, M.E.; Jokipit, J.R. (Maryland Univ., College Park (USA)). 1981. 17p. NTIS, PC A02/MF A01.

A model of the anomalous component of the quiet-time cosmic ray flux is presented in which ex-interstellar neutral particles are accelerated continuously in the polar regions of the solar-wind termination shock, and then drift into the equatorial regions of the inner heliosphere. The observed solar-cycle variations, radial gradient, and apparent latitude gradient of the anomalous component are a natural consequence of this model.

41761 (NASA-CR—164469) **Solar radio emission.** Goldman, M.V.; Smith, D.F. (Colorado Univ., Denver (USA)). May 1981. 123p. NTIS, PC A06/MF A01.

Active areas of both observational and theoretical research in which rapid progress is being made are discussed. These include: (1) the dynamic spectrum or frequency versus time plot (2) physical mechanisms in the development of various types of bursts (3) microwave type 1, 2, 3, and moving type 4 bursts (4) bursts caused by trapped electrons (5) physics of type 3bursts (6) the physics of type 2 bursts and their related shocks (7) the physics of both stationary and moving traps and associated type 1 and moving type 4 bursts and (8) the status of the field of solar radio emission.

41762 (NASA-CR—166666) **University of California electron and x-ray experiments on ISEE-3. final report, 11 Apr. 1975 - 31 Oct. 1980.** Anderson, K.A. (California Univ., Berkeley (USA)). Jan 1981. 78p. NTIS, PC A05/MF A01.

The history of the University of California solar and interplanetary electron experiment and the solar X-ray experiment is outlined, and the two instruments used are described. The roles of personnel are mentioned and the data analysis projects completed or begun are summarized. A bibliography is included.

41763 (NASA-TM—76232) **Recognition of binary x-ray systems utilizing the Doppler effect.** Novak, B.L. (National Aeronautics and Space Administration, Washington, DC (USA)). Aug 1980. 19p. NTIS, PC A02/MF A01.

The possibility of recognizing the duality of a single class of X-ray systems utilizing the Doppler effect is studied. The procedure is based on the presence of a period which coincides with the orbital period at the intensity of the radiation in a fixed energy interval of the X-ray component of a binary system.

41764 (NASA-TM—80738) **On the origin of the March 5, 1979 gamma ray transient: a vibrating neutron star in the Large Magellanic Cloud.** Ramaty, R.; Bonazzola, S.; Cline, T.L.; Kazanas, D.; Meszaros, P.; Lingenfelter, R.E. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jul 1980. 16p. NTIS, PC A02/MF A01.

It is proposed that a vibrating neutron star in the Large Magellanic Cloud is the source of the March 5 transient. Neutron star vibrations transport energy rapidly to the surface, heat the atmosphere by wave dissipation, and decay by gravitational radiation reaction. The electromagnetic emission arises from e(+)-e(-) pairs which cool and annihilate in the strong magnetic field of the neutron star. The field also confines the pairs, and this allows the production of the redshifted annihilation feature observed in the data. The redshift implies a gravitational radiation damping time which agrees with the 0.15 second duration of the impulsive phase of the event. Thus, the March 5 transient may be both the first detection of a vibrating neutron star and indirect evidence for gravitational radiation.

41765 (NASA-TM—82028) **Pulsar and diffuse contributions to the observed galactic gamma radiation.** Harding, A.K.; Stecker, F.W. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Oct 1980. 15p. NTIS, PC A02/MF A01.

With the acquisition of satellite data on the energy spectrum of galactic gamma-radiation, it is clear that such radiation has a multicomponent nature. A calculation of the pulsar gamma ray emission spectrum is used together with a statistical analysis of recent data on 328 known pulsars to make a new determination of the pulsar contribution to galactic gamma ray emission. The contributions from diffuse interstellar cosmic ray induced production mechanisms to the total emission are then reexamined. It is concluded that pulsars may account for a significant fraction of galactic gamma ray emission.

41766 (NASA-TM—82081) **Galactic x-ray emission from pulsars.** Harding, A.K. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jan 1981. 43p. NTIS, PC A03/MF A01.

The contribution of pulsars to the gamma-ray flux from the galactic plane is examined using data from the most recent pulsar surveys. It is assumed that pulsar gamma-rays are produced by curvature radiation from relativistic particles above the polar cap and attenuated by pair production in the strong magnetic and electric fields. Assuming that all pulsars produce gamma-rays in this way, their luminosities can be predicted as a function of period and magnetic field strength. Using the distribution of pulsars in the galaxy as determined from data on 328 pulsars detected in three surveys, the local gamma-ray production spectrum, the longitude profile, and the latitude profile of pulsar gamma-ray flux are calculated. The largest sources of uncertainty in the size of the pulsar contribution are the value of the mean interstellar electron density, the turnover in the pulsar radio luminosity function, and the average pulsar magnetic field strength. A present estimate is that pulsars contribute from 15 to 20 % of the total flux of gamma-rays from the galactic plane.

41767 (NASA-TM—82087) **Precursor active galaxies and the cosmic x-ray background.** Boldt, E.A.; Leiter, D. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Feb 1981. 15p. NTIS, PC A02/MF A01.

It is argued that the cosmic X-ray background (CXB) is not dominated by sources that are usual active galaxies or quasars. A comparable number of objects, young galaxies at z approximately 4 containing massive black holes surrounded by hot optically thin accretion disks, constitute the precursor active galaxies (PAG) postulated here for producing the thermal type spectrum required for the CXB. An evolutionary track for such PAG objects is described which would lead to the active galaxies observed as individual nonthermal sources. Unresolved emission from active galaxies at z 1 could then readily account for most of the nonthermal background observed in the gamma ray band.

41768 (NASA-TM—82125) **Gamma ray lines from the galactic center and gamma ray transients.** Ramaty, R.; Leiter, D.; Lingenfelter, R.E. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Apr 1981. 23p. NTIS, PC A02/MF A01.

The observations and interpretations of cosmic (nonsolar) gamma ray lines are discussed. The most prominent of these lines is the e(+)e(-) annihilation line which was observed from the Galactic Center and from several gamma ray transients. At the Galactic Center the e(+)e(-) pairs are probably produced by an accreting massive black hole (solar mass of approximately one million) and annihilate within the central light year to produce a line at almost exactly 0.511 MeV. In gamma ray transients the annihilation line is redshifted by factors consistent with neutron star surface redshifts. Other observed transient gamma ray lines appear to be due to cyclotron absorption in the strong magnetic fields of neutron stars,

and nuclear deexcitations and neutron capture, which could also occur on or around these objects.

41769 **(NASA-TM—82132) NASA contributions to the 17th international cosmic ray conference.** (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Apr 1981. 9p. NTIS, PC A02/MF A01.

The propagation and transport of cosmic rays are investigated. The role of magnetic helicity is explored.

41770 (NASA-TM—82132, pp 2-4) **Determination of magnetic helicity in the solar wind and implications for cosmic ray propagation.** Matthaeus, W.H.; Goldstein, M.L. Apr 1981. NTIS, PC A02/MF A01.

In NASA contributions to the 17th international cosmic ray conference.

The mean value of the correlation between local magnetic field and vector potential, known as the magnetic helicity, is a measure of the lack of mirror reflection symmetry of magnetic covariances in a turbulent medium. A method is presented for extraction of helicity spectra from magnetometer data, and applied to an evaluation of the magnetic helicity of interplanetary magnetic fluctuations.

41771 (NASA-TM—82132, pp 5-8) **The role of magnetic helicity in cosmic ray transport theory.** Goldstein, M.L.; Matthaeus, W.H. Apr 1981. NTIS, PC A02/MF A01.

In NASA contributions to the 17th international cosmic ray conference.

The pitch angle scattering of cosmic ray is modified greatly if the medium through which they propagate contains significant amounts of magnetic helicity. When helicity is present in the medium, the often used expression for the pitch angle diffusion coefficient derived from quasilinear theory must be modified. These modifications are illustrated for slab and isotropic symmetries. Using measurements of helicity in the solar wind determined from single point measurements of the correlation tensor of magnetic fluctuations obtained from Voyager 2, the effects of the observed helicity on both the pitch angle and spatial diffusion coefficients are estimated.

41772 **(NASA-TM—82282) On the polarization state of hydromagnetic fluctuations in the solar wind.** Bavassano, B.; Dobrowolny, M.; Mariani, F.; Ness, N.F. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center; Comitato Nazionale per le Scienze Fisiche, Frascati (Italy). Lab. di Ricerca e Tecnologia per lo Studio del Plasma nello Spazio). Apr 1980. 25p. NTIS, PC A02/MF A01.

From presently available observations it can be inferred that the Alfvenic turbulence measured in the solar wind, predominantly on trailing edges of high speed streams, is a mixture of modes with two different polarizations, namely, Alfvenic modes and modes which are the incompressible limit of slow magnetosonic waves. Using Helios 2 magnetic data and a variance analysis, parallel (to the mean field) and perpendicular components of the fluctuations are separated and the possible correlation between such components is studied. Correlations between eigenvalues of the variance matrix are also investigated and discussed.

41773 **(PB—81-138711) Pulsation of high luminosity helium stars.** King, D.S.; Wheeler, J.C.; Cox, J.P.; Cox, A.N.; Hodsen, S.W. (National Bureau of Standards, Washington, DC (USA)). 1980. 8p. NTIS.

From Proceedings for the nonradial and nonlinear stellar pulsation workshop; Tuscon, AZ (USA) (12 Dec 1979).

For linear and nonlinear pulsations, calculations have been carried out for high luminosity helium rich stars. These stars have $Y = 0.9$ and $X(12) = 0.1$. A variety of masses have been investigated. This should place the models in the region of the H-R diagram occupied by the R CrB stars. Attempts are made to place limiting values on the stellar parameters L, (T/sub e/), and mass. One of the results of this calculation is to show that the blue edge of the pulsational instability strip for helium stars depends on the importance of radiation pressure. The dynamic behavior of these stars is discussed along with their possible evolutionary state.

41774 **(PB—81-233744) Vibrationally excited silicon monoxide masers. Final report.** Buhl, D.; Clark, F.O.; Chin, G.; Glenar, D.; Kostiuk, T. (National Bureau of Standards, Washington, DC (USA)). 1980. 2p. Proceedings of Symposium International Astronomical Union (87th), Mont Tremblant, Quebec, Canada, August 6-10, 1979, Paper in Interstellar Molecules, p537-538 1980.

Published data on a select group of SiO maser sources has been analyzed for velocity variations as a function of phase. No apparent correlation was found to a level of about 2 km/s. This places constraints on the location of the maser molecules. Such a correlation should be present at some level. The implications for future high resolution infrared measurements are discussed.

41775 **(PB—81-246696) Solar-geophysical data number 441, May 1981. Part II (comprehensive reports). Data for November 1980.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). May 1981. 60p. (SGD—441-PT-2). NTIS, PC A04/MF A01.

In addition to an index for 1980-1981, this issue of comprehensive reports provides data for November 1980 on: solar radio emission, solar x-ray radiation, and mass ejections from the sun. A new schedule will cause the Daily Flare Index and the Regional Flare Index to appear 13 and 14 months from the date of observation. Publication of the Abbreviated Calendar Record is being suspended indefinitely. Some other sources of Data are listed.

41776 **(PB—81-247371) High resolution absolute flux profiles of the Mg II h and k lines in evolved F8 to M5 stars. Final report.** Stencel, R.E.; Mullan, D.J.; Basri, G.S.; Linsky, J.L. (National Bureau of Standards, Washington, DC (USA)). 1981. 8p. Proceedings of the Year of IUE: The Universe in Ultraviolet Wavelengths (2nd) held at Greenbelt, MD, on May 7-9, 1980, p317-324 1981.

Central results are given of a survey of the Mg II resonance line emission in a sample of over 50 evolved late-type stars, including spectral luminosity types F8 - M5 and Ia - IV. Observed and surface fluxes have been derived and correlations noted. The major findings include: (a) Mg II k emission core asymmetry transition near K1 III, analogous to that known for Ca II K; (b) a small gravity and temperature dependence of the Mg II chromospheric radiative loss rate.

41777 **(PB—82-100223) Design aspects of a laser gravitational wave detector in space. Final report.** Decher, R.; Randall, J.L.; Bender, P.L.; Faller, J.E. (National Bureau of Standards, Washington, DC (USA)). 1980. 5p. Proceedings of Active Optical Devices and Applications, Washington, DC., April 10-11, 1981, SPIE 228, p149-153 1980.

Some of the optical and mechanical aspects of a proposed laser gravitational wave antenna in space are discussed briefly. The proposed concept consists of a free-mass antenna with the test masses separated by 1,000,000 km. A laser heterodyne technique is used to measure the distance change between test masses resulting from gravitational wave interaction. The proposed scheme appears to offer the necessary sensitivity to detect gravitational radiation from binary stars predicted by General Relativity Theory.

41778 **(PB—82-104274) Comets, interstellar molecules and the origin of life. Research report.** Irvine, W.M.; Hjalmarson, A. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Forskningslaboratorium foer Elektronik). 1981. 34p. NTIS, PC A03/MF A01.

This review considers two distinct subjects: comets, and the relative abundance of molecules in the gas phase in interstellar clouds. The justification for a joint treatment lies in the possibility that comets may consist of a frozen matrix of interstellar volatiles and grains, formed during the early stages of the collapse of the molecular cloud which ultimately produced the Sun and planets. These topics may in turn be related to the origin of life. The next section reviews the observed properties of comets and current models of their nature and composition, stressing also our lack of definitive knowledge in critical areas. The following section then treats the determination of relative molecular abundances in interstellar clouds and the evidence favoring a primarily gas phase

chemistry in such regions, concluding with a new tabulation of molecular abundances in the cold cloud known as TMC-1, which has been called a 'protosolar nebula'. The final section then briefly relates these subjects to a possible role in chemical evolution.

41779 **(PB—82-106337) Solar-geophysical data number 442, June 1981. Part II (comprehensive reports). Data for December 1980, November 1979, miscellanea.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Jun 1981. 91p. NTIS, PC A05/MF A01.

In addition to an index for 1980-1981, this issue of comprehensive reports provides data for December 1980 on: solar radio emission, solar X-ray radiation, and mass ejections from the sun. A new schedule will cause the daily flare index and the regional flare index to appear 13 and 14 months from the date of observation. This issue contains data on solar flares for November 1979. Miscellaneous data includes: active regions Sept 25-Oct 22, 1980, synoptic solar maps Sept 25-Oct 22, 1980, and the regional flare index October 1979.

41780 **(PB—82-109497) Experimental comprehensive solar flare indices for 'major' and certain lesser flares, 1975-1979.** Dodson, H.W.; Hedeman, E.R. (World Data Center A for Solar-Terrestrial Physics, Boulder, CO (USA)). Jul 1981. 42p. NTIS, PC A03/MF A01.

In July 1971 a report on 'An Experimental, Comprehensive Flare Index and its Derivation for 'Major' Flares, 1955-1969' was published by the present authors. Requests have been received for values of the Comprehensive Flare Index (CFI) for still later years. Accordingly the present report has been prepared for 1975 through 1979, years that complete data for solar cycle 20 and provide information for the ascending branch of cycle 21. (For November-December 1979, it was necessary to use preliminary summaries of flare data. There are five components that comprise the 'profile' of the flare. The sum of the five gives the Comprehensive Flare Index (CFI). In the present study, as in the two earlier reports, values of the CFI have been derived for flares that are considered to have been well above average in either ionizing, H alpha, or radio frequency radiation.

41781 **Galactic Center: California Institute of Technology, 1982.** Riegler, G.R.; Blandford, R.D. (eds.). New York, NY; American Institute of Physics (1982). 226p. (CONF-820139—). American Inst. of Physics, 335 E. 45th St., New York, NY 10017.

From Workshop on the galactic center; Pasadena, CA, USA (7 Jan 1982).

The Workshop on the Galactic Center was held at the California Institute of Technology on January 7 and 8, 1982. Its purpose was to review observations and models of the Galactic Center, and to encourage an exchange of opinions among persons interested in physical processes and observable features of the Galactic Center. The concept for this workshop was formed when new discoveries prompted researchers in gamma-ray astronomy to contact their colleagues for the latest results in radio and infrared astronomy, and vice versa. In this volume, the authors of both the invited and contributed papers were given the opportunity to elaborate upon their talks to provide more detail than could be presented at the meeting.

41782 **Equation of state experiments and theory relevant to planetary modelling.** Ross, M.; Graboske, H.C. Jr.; Nellis, W.J. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Philosophical Transactions of the Royal Society of London, Series A: Mathematical and Physical Sciences;* **303**: No. 1477, 303-313(24 Dec 1981).

In recent years there have been a number of static and shockwave experiments on the properties of planetary materials. The highest pressure measurements, and the ones most relevant to planetary modelling, have been obtained by shock compression. Of particular interest to the Jovian group are results for H_2, H_2O, CH_4 and NH_3. Although the properties of metallic hydrogen have not been measured, they have been the subject of extensive calculations. In addition recent shock wave experiments on iron report to have detected melting under Earth core conditions. From this data theoretical models have been developed for computing the equations of state of materials used in planetary studies. A compelling feature that has followed from the use of improved material properties is a simplification in the planetary models.

41783 **Spectra and anisotropies of ions >=30 keV near the earth's bow shock.** Scholer, M.; Hovestadt, D. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Extraterrestrische Physik); Ipavich, F.M.; Gloeckler, G. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy); Fisk, L.A. (New Hampshire Univ., Durham (USA)). pp 472 of Conference papers. 17. International cosmic ray conference, Paris, 13-25 July 1981. Vol. 3, SH1 Session. Paris, France; Commissariat a l'Energie Atomique (1981).

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

41784 **Statistical analysis of beams of upstreaming ions > or approximately 30 keV near the earth's bow shock.** Klecker, B.; Scholer, M. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Extraterrestrische Physik). pp 473 of Conference papers. 17. International cosmic ray conference, Paris, 13-25 July 1981. Vol. 3, SH1 Session. Paris, France; Commissariat a l'Energie Atomique (1981).

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

41785 **Upstream protons measured on ISEE-3 and their connection to the earth's bow shock.** Sanderson, T.R.; Reinhard, R.; Wenzel, K.P. (European Space Research and Technology Centre, Noordwijk (Netherlands)). pp 478-481 of Conference papers. 17. International cosmic ray conference, Paris, 13-25 July 1981. Vol. 3, SH1 Session. Paris, France; Commissariat a l'Energie Atomique (1981).

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

We examine the relation between the occurrence of upstream proton events at ISEE-3 and the existence of a proton connection path between the spacecraft and the Earth's bow shock, by considering the upstream motion of the particle, and its ExB drift due to the downstream motion of the frozen-in magnetic field. When there is a good correlation between ISEE-3 and ISEE-1 magnetic field measurements, we find that (i) the onset and end of the event can be predicted with an accuracy of a few minutes; (ii) upstream events are only observed when a connection path exists between ISEE-3 and the Earth's bow shock. We have not yet observed the existence of a connection path between the spacecraft and the bow shock together with no upstream particles at ISEE-3.

41786 **ISEE-3/IMP-8 observations of simultaneous upstream proton events.** Sanderson, T.R.; Reinhard, R.; Wenzel, K.P. (European Space Research and Technology Centre, Noordwijk (Netherlands)); Mitchell, D.G.; Roelof, E.C. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). pp 482 of Conference papers. 17. International cosmic ray conference, Paris, 13-25 July 1981. Vol. 3, SH1 Session. Paris, France; Commissariat a l'Energie Atomique (1981).

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

41787 **Anisotropy characteristics of upstream proton events.** Sanderson, T.R.; Domingo, V.; Reinhard, R.; Wenzel, K.P. (European Space Research and Technology Centre, Noordwijk (Netherlands)). pp 483-486 of Conference papers. 17. International cosmic ray conference, Paris, 13-25 July 1981. Vol. 3, SH1 Session. Paris, France; Commissariat a l'Energie Atomique (1981).

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

We present results of a detailed analysis of proton anisotropies observed during an upstream event when ISEE-3 was approximately 80 Rsub(E) upstream from the Earth, and close to the Sun-Earth radial. During the first part of the event, particles were ob-

served streaming mainly from the direction of the Earth along the magnetic field. Later in the event, the angular distributions broadened until towards the end of the event, approximately equal intensities were observed with pitch angles from 0° up to 120°, with essentially no particles with pitch angles close to 180°. Here a 0° pitch angle particle is defined as a particle moving upstream along the magnetic field. Large amplitude low-frequency waves were observed in the magnetic field at ISEE-3 whenever enhanced fluxes of 90° protons were observed. It is argued that the 90° protons are the result of pitch angle scattering of the upstream moving protons in the region between the bow shock and ISEE-3.

41788 **Boundary effects in upstream proton events.** Reinhard, R.; Sanderson, T.R.; Wenzel, K.P. (European Space Research and Technology Centre, Noordwijk (Netherlands)). pp 487-490 of Conference papers. 17. International cosmic ray conference, Paris, 13-25 July 1981. Vol. 3, SH1 Session. Paris, France; Commissariat a l'Energie Atomique (1981).

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

The structure of particle populated regions approximately 200 Rsub(E) upstream from the Earth's bow shock is investigated using three-dimensional low-energy proton observations in the energy range 35-1600 keV onboard ISEE-3. The structure of the regions reveals itself at the onsets and ends of upstream proton events when the boundaries of the regions are carried past the spacecraft by the solar wind. During such crossings we observe i) a characteristic change in the energy spectrum which in some cases is a turnover towards lower energies and ii) characteristic gradient anisotropies which are directed oppositely to each other at the onset and end of the event. These observations are consistent with a model where upstream particles propagate in sheets or slabs from the Earth's bow shock out to ISEE-3.

41789 **Acceleration mechanisms for energetic particles in the earth's magnetosphere.** Schiferl, S.; Fan, C.Y. (Arizona Univ., Tucson (USA). Dept. of Physics); Erickson, K.N. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy); Gloeckler, G. (Minnesota Univ., Minneapolis (USA). School of Physics and Astronomy); Hovestadt, D. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Extraterrestrische Physik). pp 491 of Conference papers. 17. International cosmic ray conference, Paris, 13-25 July 1981. Vol. 3, SH1 Session. Paris, France; Commissariat a l'Energie Atomique (1981).

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

41790 **Observation of magnetospheric protons with energy above 25 keV in interplanetary space in March-April 1977.** Bacilova, R.N.; Rumin, S.P.; Stolpovsky, V.G.; Sharvina, K.N.; Shesterikov, V.F. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). pp 492-495 of Conference papers. 17. International cosmic ray conference, Paris, 13-25 July 1981. Vol. 3, SH1 Session. Paris, France; Commissariat a l'Energie Atomique (1981).

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

In this report the data are presented, concerning observation of protons at high geographic latitudes, made during the function of "Prognoz-5". "Prognoz-5" satellite had highly excentric orbit with apogee at 31 R and 65° North Latitude.

41791 **Dynamics of the low latitude boundary of penetration of SCR low-energy protons.** Ivanova, T.A.; Kuznetsov, S.N.; Sosnovets, E.N. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). pp 496-499 of Conference papers. 17. International cosmic ray conference, Paris, 13-25 July 1981. Vol. 3, SH1 Session. Paris, France; Commissariat a l'Energie Atomique (1981).

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

The proton fluxes of solar cosmic rays (SCR) over the polar caps in the magnetosphere were studied on the "Cosmoc-480" satellite in August 3-10, 1972. The empirical formula dependence of the penetration boundary of SCR with Esub(p)>1 MeV in the dayside and nightside sector were obtained. A theoretical model of formation of the nightside boundary of SCR penetration that accords with the experiment, is proposed.

41792 **(NASA-TM—75704) Algorithm and program for information processing with the filin apparatus.** Gurin, L.S.; Morkrov, V.S.; Moskalenko, Y.I.; Tsoy, K.A. (National Aeronautics and Space Administration, Washington, DC (USA)). Sep 1979. Translated from Algorithm i programma obrabotki informatsii s probora filin, Moscow; 1977, pp 1-18. 20p. NTIS PC A02/MF A01.

The reduction of spectral radiation data from space sources is described. The algorithm and program for identifying segments of information obtained from the Film telescope-spectrometer on the Salyut-4 are presented. The information segments represent suspected X-ray sources. The proposed algorithm is an algorithm of the lowest level. Following evaluation, information free of uninformative segments is subject to further processing with algorithms of a higher level. The language used is FORTRAN 4.

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41793 **(AD-A—097712/4) Ionospheric electron density profile and related studies. Final report, 22 November 1977-30 September 1981.** Basu, B.; Chang, T.S.; Smith, E.R. (Boston Coll., Chestnut Hill, MA (USA). Mass Space Data Analysis Lab.). 3 Feb 1981. 59p. (BC-SDAL—81-1). NTIS PC A04/MF A01.

There are many problems of practical interest in the study of the Earth's ionosphere that require a detailed knowledge of the electron energy distribution and the electron density profile. This report summarizes our theoretical efforts in explaining the observed electron distribution functions. Boltzmann-Fokker-planck theory has been used, and the resulting kinetic equation has been analyzed. A systematic study of the collision operators that appear in the kinetic equation has been done. Electrostatic plasma instabilities have been investigated in order to explain the observed anomalous structure of the electron energy distribution in the 2-4 eV range. In a related study, the problem of auroral proton precipitation has been solved analytically. The analysis enables us to calculate the precipitating proton-hydrogen fluxes, energy deposition rate, and the electron density profile resulting from ionization.

41794 **(AD-A—097713/2) Auroral x-ray contamination of the low energy proton spectrometer on the S3-2 satellite in the polar regions. Report for 1 January-31 August 1980.** Boyle, R.P.; Parsignault, D.R. (Emmanuel Coll., Boston, MA (USA)). 31 Jan 1981. 32p. NTIS PC A03/MF A01.

The Low Energy Proton Spectrometer (LEPS) on board the Air Force S3-2 polar orbiting satellite recorded, at polar latitudes, high anomalous counts coming from the auroral zone direction, over the December 1975 through April 1976 operational period. Despite the low sensitivity of the Si(Li) LEPS detector to X-rays, bremsstrahlung from precipitating electrons in the hundred keV energy range is given as the source of these observations.

41795 **(AD-A—097875/9) Direct measurements of electron density, temperature and ion composition in an equatorial spread-f ionosphere. Memorandum report.** Narcisi, R.S.; Szuszczewicz, E.P. (Naval Research Lab., Washington, DC (USA)). 17 Mar 1981. 39p. (NRL-MR—4445). NTIS PC A03/MF A01.

Ionospheric plasma irregularities have been studied on each of two rockets launched into significantly different conditions of equatorial spread-F. In the first operation (into a spread-F decay phase) a number of major depletions were distributed throughout the F-region from its bottomside gradient centered near 260 kilometers, through the F-peak, to a topside altitude of 500 kilometers. In a second operation (launched into a mid-phase development of spread-F) irregularities were observed only on the bottomside gradient, with no depletions in or above the F-peak.

41796 **(AD-A—098108/4) Near infrared spectrometric airglow measurements during the total solar eclipse of 26 February 1979. Final report, 2 February 1972-31 July 1980.** Pendleton, W.R. Jr.; Baker, D.J.; Steed, A.J. (Utah State Univ., Logan (USA). Electro-Dynamics Labs.). 15 Jan 1981. 37p. NTIS PC A03/MF A01.

Spectrometric airglow measurements during the solar eclipse of 26 February 1979 have yielded first-of-a-kind residual airglow spectra during the total phase of the eclipse. The temporal variations of the O2 infrared atmospheric features and the He multiplet at 1.083 microns are consistent with current excitation/emission models; however, the OH Meinel emission levels decreased almost monotonically by totality, in contrast with expectations based on most code predictions. Twilight transition, nightglow and auroral data were also acquired to characterize airflow conditions during the general timeframe of the eclipse. The twilight-transition results compare favorably with similar earlier measurement by other investigators.

41797 **(AD-A—102760/6) Observations of high-speed plasma flow near the earth's magnetopause: evidence for reconnection. Scientific report for 1978.** Eastman, T.E.; Frank, L.A. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Jun 1981. 59p. (U.ofIowa—81-16). NTIS, PC A04/MF A01.

In an attempt to confirm the evidence for reconnection reported by Paschmann et al. (1979) we have examined three-dimensional plasma velocity distributions sampled near the magnetopause using the LEPEDEA plasma instrument. During the magnetopause crossing of 8 September 1978, we observe high-speed plasma flow in the magnetospheric boundary layer which is suggestive of the accelerated flow predicted by reconnection models. However, simultaneous measurements of > or = 45 keV energetic electrons show pancake-shaped pitch-angle distributions which indicate a closed field line regime where as the highspeed plasma flow is predicted to occur on open field lines for the reconnection hypothesis. Low-energy plasma and energetic ion observations do not show any evidence for a local flow component normal to the magnetopause, and the energetic particle measurements show no evidence for a finite normal magnetic field component. Since the energentic particle angular distributions indicate that the high-speed plasma flow occurs partly or entirely on closed field lines, we suggest that the simplest hypothesis is to place the entire boundary layer observed during this crossing on closed field lines. We find that several detailed features of the available measurements can be explained readily in this way. Our ISEE observations appear to be most consistent with impulsive injection of magnetosheath plasma across the magnetopause in a process that involves both MHD and plasma kinetic instabilities.

41798 **(AD-A—102880/2) Mesosphere and thermosphere.** Champion, K.S.W.; Schmidtke, G. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1981. 250p. (AFGL-TR—81-0210). NTIS, PC A11/MF A01.

From Tropical meeting of the COSPAR Interdisciplinary Scientific Commission C; Budapest, Hungary (2 Jun 1980).

This publication contains a number of specialized papers on two topics. The first topic is representation of energy sources in the Earth's upper atmosphere and ionosphere. The energy sources include the solar wind and electromagnetic radiation, particle precipitation, joule heating in the electrojets, and energy transfer by gravity wave dissipation. The second topic is concerned with models of the terrestrial upper atmosphere. The subdivisions include the stratosphere, mesosphere, thermosphere and exosphere. Properties considered are total mass density, composition, radiative cooling, temperature, winds, diffusion, and turbulence.

41799 **(AD-A—102905/7) Approximate analytic solutions for the primary auroral electron flux and related quantities. Environmental research papers.** Jasperse, J.R.; Strickland, D.J. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 3 Mar 1981. 39p. (AFGL-TR—81-0069; AFGL-ERP—730). NTIS, PC A03/MF A01.

It is shown that the linear transport equation may be solved exactly for the primary auroral electron flux in plane-parallel geometry in the forward scattering and average, discrete, energy-loss approximations. In this approximation inelastic scattering is taken into account but elastic scattering drops out and the solution is an approximation to the flux in the downward hemisphere. Using the multiple scattering method, we obtain the solution as a finite sum of analytic functions of altitude, energy, and pitch angle where each term is multiplied by the energy shifted electron flux incident at the top of the auroral ionosphere. Closed form expressions are also found for the hemispherically averaged primary electron flux, the energy deposition rate, and the ionization rate. For a unidirectional incident flux we show that the energy deposition rate is a superposition of generalized Chapman functions of altitude, and for an isotropic incident flux we show that the energy deposition rate is a superposition of generalized J functions of altitude. The notion of pseudoparticles is discussed and used to approximate the sums which occur in the above formulae. We also compare our analytic approximations to some numerical solutions of the problem.

41800 **(AD-A—103027/9) Plausible hypothesis for striation freezing in ionospheric plasma clouds. Memorandum report.** Ossakow, S.L.; Zalesak, S.T.; Keskinen, M.J. (Naval Research Lab., Washington, DC (USA)). 18 Aug 1981. 22p. (NRL—4597). NTIS, PC A02/MF A01.

Ionospheric plasma cloud striation phenomena exhibit a persistence of kilometer scale size structures, i.e., a freezing. Beyond a certain point in time the striations drift in unison without further bifurcation. Recent theoretical and nonlinear numerical simulation studies using a one level, 2D plasma cloud model with cross field diffusion produced a U shaped curve for minimum striation scale size, i.e., a structure's stability against further bifurcation, as a function of cloud to background Pedersen conductivity ratio (M). The minimum of the U (occurring for M approx. = 4), with classical electron-ion collisions (diffusion), results in a minimum scale size L sub o approx. = 10-20m. Even with M = 30, the results produced L sub o = 50m, clearly are not the kilometer type scale sizes observed. On the other hand nonlinear numerical simulation studies using a two level, 2D model, without electron-ion collision induced diffusion, showed that high density cloud striations create, as time goes on, high density image striations beneath them in the background ionosphere. This effectively increases the Pedersen conductivity associated with the cloud striations. Knowing these two results and extrapolating the U shaped curve to higher M, yields L sub o approx. = 500m for M approx. = 300. Thus it is proposed that the second level (background ionosphere) effect of amplifying the conductivity in a striation, via image striations because the second level is compressible, could result in km size minimum scale sizes (non-bifurcation), as time goes on.

41801 **(AD-A—104109/4) Magnetospheric and geomagnetic activity during the first year (1979) of the Scatha (p78-2) satellite operation. Final report 1 Oct 79-30 Sep 80.** Meng, Ching-I. (Johns Hopkins Univ., Silver Spring, MD (USA). Applied Physics Lab.). Dec 1980. Contract MIPR-FY71218000009. 397p. NTIS, PC A17/MF A01.

This report consists of two parts. The first is a comprehensive analysis of the geomagnetic field variations observed by several networks of ground-based stations to monitor the magnetospheric conditions during the first year of the SCATHA satellite operation in 1979, together with the determination of the most disturbed and quietest days during the 1979 period. The second part is a summary of the scientific results in the investigation of polar region electron precipitations based on USAF DMSP observations. The daily graphs and listing of 1.0 minute auroral electrojet activity index (AE) constructed from three networks of the magnetic field observations over the Northern American Continent are illustrated as Appendices 2 and 3, respectively.

41802 **(NASA-CR—164372) Research on solar-wind and magnetospheric electric fields and plasmas. Final report, 1 Oct 1979 - 1 May 1981.** Burch, J.L. (Texas Univ., San Antonio (USA)). May 1981. 22p. NTIS, PC A02/MF A01.

The phenomena of particle precipitation and ion convection at high latitudes and their response to variations in the interplanetary magnetic field. Data from the low energy electron experiment and the retarding potential analyzer drift meter on Atmosphere Ex-

plorers C and D were analyzed. Additional data from the spacecraft Imp-J were utilized.

41803 (NASA-CR—164372, pp 16) **A satellite investigation of energy flux and inferred potential drop in auroral electron energy spectra.** Meniett, J.D.; Burch, J.L. (Southwest Research Inst., Houston, TX). May 1981. NTIS, PC A02/MF A01.

In Research on solar-wind and magnetospheric electric fields and plasmas. Final report, 1 Oct 1979 - 1 May 1981.

Because the predicted relationship (epsilon directly varies with V squared) between auroral electron energy flux (epsilon) and the inferred acceleration potential drop (V) for accelerated Maxwellian distributions was favorably tested by using other sounding rocket data for the limiting case of eVE 1 (where Ec is the characteristic energy of the accelerated Maxwellian distribution) and for a single inverted-V observed by the Injun 5 satellite, data from Atmosphere D were used to extend these studies over the range .2 eV/Ec 5 and for a wide range of latitudes and local times on both the nightside and the dayside. Results show good agreement with the full accelerated Maxwellian model. An analytical approximation to the electron energy flux was derived which better describes the data over the range .2 eV/Ec approximated 3. Analyses of individual energy spectra at small and large pitch angles through well-defined inverted-V structures suggest that the altitude of the inferred potential drop maximizes near the center of the inverted-V's.

41804 (NASA-CR—164534) **Rocket study of auroral processes. Final report, 1 May 1978 - 30 Jun 1981.** Arnoldy, R.L. (New Hampshire Univ., Durham (USA)). Jun 1981. 77p. NTIS PC A05/MF A01.

Abstracts are presented of previously published reports analyzing data from three Echo 3 rocket flights. Particle experiments designed for the Terrier-Malmute flight, the Echo 5 flight, and the Norwegian Corbier Ferdinand 50 flight are described and their flight performance evaluated. Theoretical studies on auroral particle precipitation are reviewed according to observations made in three regions of space: (1) the region accessible to rockets and low altitude satellites (few hundred to a few thousand kilometers) (2) the region extending from 4000 to 8000 km (S3-3 satellite range) and (3) near the equatorial plane (geosynchronous satellite measurements). Questions raised about auroral arc formation are considered.

41805 (NASA-CR—174637) **Sounding rocket research Aries/Firewheel, Series 22, Issue 15. Final report, 1 Jun 1968 - 28 Feb 1981.** Mozer, F.S. (California Univ., Berkeley (USA)). Feb 1981. 109p. NTIS PC A06/MF A01.

Rocket experiments in ionospheric particle and field research flow in seven programs during the last decade are summarized. Experimental techniques were developed and are discussed including the double-probe field technique. The auroral zone, polar cap, and equatorial spread F were studied.

41806 (NASA-TM—82147) **Multiple crossings of a very thin plasma sheet in the earth's magnetotail.** Fairfield, D.H.; Hones, E.W. Jr. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jun 1981. 40p. NTIS PC A03/MF A01.

High resolution magnetic field, plasma and energetic particle data from the IMP-8 spacecraft were studied for multiple crossings of the Earth's magnetotail plasma sheet when it becomes thin during magnetospheric substorms. Traversals recur on a time scale of several minutes and they are associated with high velocity plasma flows that are usually directed tailward but are occasionally directed earthward for brief intervals. Observations are explained by rapid oscillations of a plasma sheet that is only a few thousand km thick, a dimension comparable to the gyroradius of energetic protons. Differences in the angular distributions of the two energies indicate that the higher energy protons are preferentially located on field lines deeper in the tail lobe. A neutral line acceleration model is supported tailward streaming energetic electrons which are occasionally present at the lobe plasma sheet interface.

41807 (NASA-TM—76216) **Photometric and radar observations of an excited eruption in the Zarnitsa-2 experiment.** Adeyshvili, T.G.; Zarnitskii, Y.F.; Lyakhov, S.B.; Managadze, G.G.; Pyatsi, A.K. (National Aeronautics and Space Administration, Washington, DC (USA)). Jul 1980. Translation of Fotometricheskiay i radiolokatsionnyye nabiyudeniya stimulirovaogo vysypaniya v eksperiments zarnitsa-2; Inst. of Space Research, Academy of Sciences (USSR), Moscow, 1978, 18p. 17p. NTIS PC A02/MF A01.

In a controlled experiment a ground photometer and radar station recorded an increase in night sky luminescence following injection of an electron beam into the atmosphere from a rocket at altitudes 80 to 154 km. A main and supplementary scattering and luminescene regions were observed. The effect is presumed to be due to electron eruption induced by artificial action on the magnetosphere.

6403 Atomic, Molecular, And Chemical Physics

41808 (AD-A—098066/4) **Theory and experiments on chemical instabilities. Final report, December 1976-December 1980.** Ross, J. (Stanford Univ., CA (USA). Dept. of Chemistry). Jan 1981. 41p. NTIS PC A03/MF A01.

The Franck-Condon approximation of treating an electronic transition in a molecular system at fixed nuclear coordinates is shown to provide qualitatively correct predictions. The theory was applied to both adiabatic and nonadibatic collisions. So far only relative rates have been calculated and the challenge of predicting absolute rates remains open. A stochastic theory of nucleation in phase transitions has been developed in which the equivalence of a thermodynamic and kinetic formulation of critical cluster sizes is shown. Suitable use of a combination of a master equation and a form of transition probability according to Langer has been shown to lead to a most probable evolution in time which is in fact the deterministic rate equation. An extensive investigation of the formal theory of statistical mechanics of stationary states has begun.

41809 (AD-A—098265/2) **Properties of the excited states of molecular ions. Final report, 1 October 1977-15 September 1980.** Cosby, P.C.; Moseley, J.T.; Peterson, J.R.; Helm, H.P.; Lee, L.C. (SRI International, Menlo Park, CA (USA). Molecular Physics Lab.). 13 Apr 1981. 127p. (SRI-MP—81-72). NTIS PC A07/MF A01.

The techniques of photodissociation-spectroscopy and photofragment spectroscopy were developed and applied to characterize the excited states of a number of important molecular ions that occur in both natural and laboratory discharges and plasmas. Dissociative excited states in $O_2(+)$ and NO(+) were identified, together with their predissociation mechanisms, using photofragment spectroscopy techniques. This work yielded an order of magnitude improvement in resolution over conventional spectroscopic techniques, measurements of predissociation lifetimes, and several new observations of molecular dynamics and properties. In NO(+) a complicated band system was found to consist of transitions to predissociated levels of the previously unobserved 2 3 Pi state. These studies will have a major impact on current knowledge of NO(+) excited states. The structure of the OONO(-) isomer of $NO_3(-)$ was confirmed, and the probable mechanism for its stabilization in atmospheric reactions was identified as due to clustering with H_2O, which preserves its structure and prevents conversion to $NO_3(-)$. The possibility that previous observations of $CO_3(-)$ photodissociation in a drift tube can be attributed to excited ions was investigated. The results showed that the drift tube $CO_3(-)$ ions are in the ground state, but were not able to resolve the discrepancy in the $CO_3(-)$ bond dissociation energy.

41810 (AD-A—103106/1) **Excitation and ionization cross sections for electron beam and microwave energy deposition in air. Memorandum report.** Ali, A.W. (Naval Research Lab., Washington, DC (USA)). 20 Aug 1981. 55p. (NRL-MR—4598). NTIS, PC A04/MF A01.

A set of excitation and ionization cross section for electron collisions in N2, O2, N and O are presented.

41811 **(AD-A—104002/1) Interaction potentials for Br(2p) + Ar, Kr, Xe (1s) by the crossed molecular beams method. Interim report.** Casavecchia, P.; He, G.; Sparks, R.K.; Lee, Y.T. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1981. 54p. NTIS, PC A04/MF A01.

Angular distributions of Br((2)P sub 3/2, 1/2) scattered off Ar, Kr, and Xe ((1) S sub 0) in the thermal energy range were measured in crossed molecular beams experiments. Interaction potentials for the X(1/2) and I(3/2) states are derived by using an approximate elastic scattering analysis, which neglects interstate coupling, as previously done for F-Xe,Kr,Ar,Ne and Cl-Xe. While the Br-Xe X(1/2) potential (epsilon = 0.645 kcal/mole, r sub m = 3.80 A) shows a stronger interaction than the interaction potential of Kr-Xe, the Br-Kr (epsilon = 0.460 kcal/mole, r sub m = 3.90 A) and Br-Ar (epsilon = 0.380 kcal/mole, r sub m = 3.73 A) X(1/2) potentials are closer to those of the corresponding rare gas pairs. The I(3/2) potential for all three systems is found to have a shallower epsilon, a slightly larger r sub m and a more repulsive wall than the 1(Sigma +) potential of the corresponding rare gas pair. The origin of these interactions is discussed and an attempt to examine the rare gas halides ground state bonding is presented.

41812 **(AD-A—104094/8) Intense pulsed proton source: time and wavelength resolved studies of xenon, liquid xenon, and XeF_2. Final contractors report 31 May 79-29 Jan 81.** Williams, J.R.; Gaiser, J.E. (Auburn Univ., AL (USA). Dept. of Physics). 26 Jun 1981. Contract DASG60-79-C-0079. 103p. NTIS, PC A06/MF A01.

Time and wavelength resolved spectroscopic measurements have been performed for xenon gas excited by 2.0 MeV protons. Reaction rate constants for the formation and decay of the 3 Sigma sub u and the 1 Sigma sub u states in Xe sub 2* via three body collisions are 31 Hz/Torr square and 61 Hz/torr square, respectively. A kinetic model based on the experimental facts is presented and is examined. The lifetime of the 3 Sigma sub u state in Xe sub 2* has been measured to be 102 ns. Single proton counting techniques were used, and both the 172 nm radiation from the 3 Sigma sub u state as well as the 152 nm radiation from the 1 Sigma sub u state were monitored as a function of time and pressure. The rate constants of interest have been extracted from the pressure dependence of the decay times. Ion recombination kinetic processes were clearly distinguishable at higher pressures and could be dealt with independently from the excited state channel reactions. Tests were performed to insure that events which occur late in time following excitation were actually ion recombination processes. Absolute conversion efficiencies were measured for proton energy input to 172 nm proton energy output.

41813 **(CONF-820335—1) Positron spectroscopy applied to the analysis of surfaces.** Hulett, L.D.; Dale, J.M.; Pendyala, S.; Chang, Y.K.; Lyon, W.S. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE82008836.

From International symposium on applications and technology of ionizing radiations; Malaz, Riyadh, Saudi Arabia (12 Mar 1982).

The interaction with solid material of positrons emitted from radioactive sources has been studied for many years, but applications to surface analyses have been rather limited. Positrons from sources such as ^{58}Co and ^{22}Na have energies ranging as high as 450 to 550 keV; thus they penetrate deep inside the solids before being reduced to energies convenient for surface spectroscopies. Also, since the energy distributions are continuous, it is impossible to make the necessary high resolution energy loss measurements for such things as element identification. Recently some new techniques for generating monoenergetic positrons have been developed which eliminate some of these problems, and new surface spectroscopies are being investigated. At ORNL and other institutions monoenergetic positron guns which output fluxes in excess of 100,000 counts sec^{-1} cm^{-2} are now available. Thus we are able to perform such measurements as positron energy loss spectroscopy, positron diffraction, threshold spectroscopies, and other surface experiments heretofore possible only with electrons. Since the same instrumentation can be used for both positrons and electrons, the incorporation of positron spectroscopy in standard surface analysis manifolds appear to be quite practical. In this paper accomplishments at ORNL over recent years and prognosis of future applications such as high energy positron diffraction are presented.

41814 **(DOE/ER/10669—1) Free-charged-particle behavior in intense laser fields. Technical progress report, July 15, 1980-July 14, 1981.** Fradkin, D.M. (Wayne State Univ., Detroit, MI (USA). Dept. of Physics). 23 Feb 1982. Contract AC02-80ER1060669. 17p. NTIS, PC A02/MF A01. Order Number DE82008782.

The effects of intense laser fields on electrons, and what features might arise in the electrons' behavior as a result of the interaction are studied. Earlier work involving a classical treatment through second order of the Lorentz-Dirac equation indicated that with just a laser field, and no auxiliary fields, radiation reaction effects allowed an asymptotic transfer of energy-momentum from an intense laser pulse to a charged particle itself. This work was extended to third order, and explicit expressions for the particle's maximum energy gain per pulse show that it depends primarily on the total pulse energy per unit area of pulse front, and that the influence of laser polarization and frequency (which only come into play in a third-order treatment) are not very significant. (GHT)

41815 **(NBS-LP—92-Supp.3) Multiphoton bibliography.** Eberly, J.H.; Gallagher, J.W. (eds.). (Rochester Univ., NY (USA). Dept. of Physics and Astronomy; Colorado Univ., Boulder (USA)). Dec 1981. Contract AS03-76DP01118. 70p. NTIS, PC A04/MF A01. Order Number DE82008152.

A bibliography is presented of approximately 275 references from literature published since 1980 on multiphoton research. A subject list is provided which divides the references into four subdivisions, i.e., ionization, bound-bound transitions, dissociation, and free-free transitions. An author index is included. (LCL)

6404 Fluid Physics

41816 **(AD-A—092624) Resonance studies of H atoms interacting with liquid helium surfaces. Annual summary report.** Crampton, S.B. (Williams Coll., Williamstown, MA (USA)). Oct 1980. Contract N00014-80-C-0240. 5p. NTIS, PC A02/MF A01.

Techniques developed by this investigator for studying the hyperfine resonance of gaseous atomic hydrogen in storage bulbs under liquid helium will be extended downwards in temperature to 0.5 K, in order to study the interactions of H atoms with superfluid liquid helium surfaces and with each other while adsorbed on the liquid helium surfaces. A liquid helium temperature state-selected H atom beam will be developed and used to study the feasibility of hydrogen maser oscillation at liquid helium temperatures.

41817 **(LBL—13959) Hamiltonian structure of multi-species fluid electrodynamics.** Spencer, R.G. (Lawrence Berkeley Lab., CA (USA)). Dec 1981. Contract W-7405-ENG-48. 7p. (CONF-811225—3). NTIS, PC A02/MF A01. Order Number DE82011778.

From Conference on dynamical systems in hydrodynamics; La Jolla, CA, USA (7 Dec 1981).

The phase space for multi-species fluid electrodynamics is the function space of fluid variables and Maxwell field variables. The Poisson bracket on phase functionals is constructed as a Lie algebra product following general methods of infinite dimensional symplectic geometry.

41818 **(UVA-ER—705-81U) Incompressible flow in a rapidly rotating cylinder with a source/sink distribution in the lateral wall and a free inner boundary (U). Technical report.** Ribando, R.J. (Virginia Univ., Charlottesville (USA). School of Engineering and Applied Science). Dec 1981. Contract AC05-82OR20900. 21p. NTIS, PC A02/MF A01. Order Number DE82011031.

The flow of an incompressible fluid in a rapidly rotating right circular cylinder is considered. A source/sink mass distribution at the lateral wall, which is azimuthally uniform and symmetric across the midplane, causes a deviation from wheel flow. The con-

tainer is only partially full and the inner free surface is allowed to deviate slightly from the vertical. A finite-difference solution of the full, non-linear governing equations was used to obtain the flow field. A special implicit technique for the Coriolis terms which maintains geostrophy was developed to give a particularly fast algorithm. The results compare quite favorably with the linearized solution.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 40336, 41841, 41849, 41852, 41857, 41868

41819 (EFI—455(62)-80) A-dependence of inclusive πsup(+-) meson photoproduction. Alanakyan, K.V.; Amaryan, M.D.; Demirchyan, R.A.; Egiyan, K.Sh.; Kocharova, Zh.L.; Oganianyan, M.S.; Sharabyan, Yu.G.; Stepanyan, S.G. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700787.

The experimental data on A-dependence of photopions in wide energy and angular intervals of secondary PI^{+-}-mesons are discussed. It is shown that if the invariant cross section of photopion production on ^{12}C, ^{27}Al, ^{63}Cu, ^{118}Sn and ^{208}Pb nuclei in the $\gamma+A\rightarrow PI^{+-}+X$ reaction is represented in the form of f approximately equal to BAsup(n), then in the energy dependence of exponent n one can observe the same singularities as in the analogous hadron processes. The expansion of the angular interval up to 20-160 deg in the laboratory system made it possible to study in detail the nature of these singularities. The attempts are made to explain the observed singularities in the energy dependence n=n(TPI) by taking into account additional (to tne direct process of photoproduction on nuclear nucleons) sources of the inclusive PI-meson production.

41820 (EFI—456(63)-80) Excitation function of photoproduction of cumulative protons on nuclei. Alanakyan, K.V.; Amaryan, M.D.; Demirchyan, R.A.; Egiyan, K.Sh.; Oganianyan, M.S.; Sharabyan, Yu.G. (Erevanskij Fizicheskij Inst. (USSR)). 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700788.

New experimental data on the energy dependence of pre-exponential constant Csub(rho) in the representation rho=f/σsub(t)=Csub(rho)exp(T/Tsub(0)) of the invariant normalized cross section of the cumulative proton photoproduction are reported. Cumulative protons are produced by the primary γ-quanta in the 2-4.5 GeV energy range on ^{12}C, ^{27}Al, ^{63}Cu, ^{118}Sn, ^{208}Pb in the $\gamma+A\rightarrow PI+X$ reaction. Normalized cross section becomes invariant in the region of 4 GeV for heavy nuclei.

41821 (IFVE-OEIPK—80-129) Inclusive production of Δii(1232) and Σ^{+-}(1385) v K^+p interactions at 32 GeV/c. Azhinenko, I.V.; Belokopytov, Yu.A.; Vorob'ev, A.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1980. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700789.

Inclusive production of Δ^{++} (1232), Σ^+ (1385) and Σ^- (1385) resonances in K^+p interactions at 32 GeV/c have been investigated. Cross section distributions in the Feynman variable x, velocities and transverse momenta are given. Main peculiarities of inclusive distributions are discussed within the framework of quark-parton models of production of baryons and diquark-quark configuration of a proton. Total inclusive cross sections of the Δ^{++} (1232), Σ^+ (1385) and E^- (1385) resonances in the K^+p interactions constituting 1770+-160, 119+-20 and 53+-16 μb, respectively, have been measured. Main peculiarities of Δ^{++}, Σsup(*+) and Σsup(*-) inclusive distributions in variable x are explained with the simplest quark diagrams qualitatively good. Δ^{++} mainly forms in the processes of recombination of valent diquark of a proton (uu). For Σsup(*+) besides this process the recombination mechanism of one of valent u-quarks is important. Σsup(*-) is produced during the recombination of a valent d-quark of proton. In the region of fragmentation of proton x<-0.5, where the mechanism of diquark recombination (coalescence) is dominated, x spectra of Σsup(*+) and Δ^{++} are similar with respect to a shape and Σsup(*+)/Δ^{++} relation of their cross sections (after substraction of contribution of diffraction dissociation to Δ^{++} cross section and with provision for the difference in Σsup(*+) and Δ^{++} masses) agrees well with the prediction of an additive quark model. The Σsup(*+) spectrum with respect to psub(T)sup(2) transverse momentum square is described by the exponential dependence, and the Δ^{++} spectrum - with the sum of two components.

41822 (IFVE-ONF—81-33) Choice of minimization parameters using 4 momentum conservation law for particle momenta improvement. Anykeev, V.B.; Zhigunov, V.P.; Spiridonov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700956.

Special choice of parameters for minimization is offered in the problem of improving estimates for particle momenta in the vertex of the event with the use of 4-momentum conservation law. This choice permits to use any unconditional minimization method instead of that of Lagrange multipliers. The above method is used when analysing the data on the $K^- + p \rightarrow n +$ anti $k^0 + \pi^0$ reaction.

41823 (JINR—1-80-858) Production of fast positive charged particles in pion-carbon interactions at 5 GeV/c. Abdinov, O.B.; Abrosimov, A.T.; Agababyan, N.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1980. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701014.

In the π^-C-interactions at 5 GeV/c accompanied with the production of positively charged and neutral particles, topological cross sections, angular and momentum distributions and mean multiplicities of secondaries are measured. Full topologic cross section of processes of pion-carbon interactions without formation of negative particles makes up (7.28+-0.41)mb. It is shown that the cascade-evaporation model poorly describes distributions over cross sections and multiplicities of fast positively charged particles and of π^0-mesons.

41824 (JINR—1-80-859) Proton angular distributions in πp12 C-interactions at 5 GeV/c with nuclear decay. Abdinov, O.B.; Abrosimov, A.T.; Bajramov, A.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1980. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701015.

Angular distributions of protons in events with complete decay of carbon nucleus are studied to test possibilities of existence of collective excitations in nucleus. Investigations have been conducted on statistics 11570 $\pi^-{}^{12}$C-interactions, obtained during irradiating one meter propane bubble chamber with π^--mesons with 5 GeV/c momentum. The results presented agree with the data, obtained at 40 GeV/c for cases with complete decay of carbon nucleus. At THETA approximately equal to 56.7 deg the value of proton angle of emission the maximum has been observed which is also observed in a special class of π^-C-interactions, accompanied with the emission of merely protons.

41825 (JINR—E-1-80-871) Charged particle multiplicities in πp and K^- meson interactions with nuclei in a streamer chamber at 40 GeV/c. Andreev, E.M.; Bohm, J.; Bahr, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1980. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700790.

Results on the multiplicities of negatively as well as positively charged particles produced in π^--meson and K^--meson interactions with nuclei of Li, C, S, Cu, CsI, and Pb at 40 GeV/c are presented. The dependence of normalized mean multiplicity of negatively charged particles, Rsup(-)=<nsup(-)>sub(hA)anti ν, in a nucleus can be fitted with $R^- = (0.78+-0.06)+(0.32+-0.04)$anti ν. On the other hand, the normalized multiplicity of all charged particles, Rsup(ch)=<nsup(ch)>sub(hA)/<nsup(ch)>sub(hN) behaves as Rsup(ch)=(0.78+-0.10)+(0.85+-0.06)anti ν. Comparing positive and negative multiplicities an excess of fast positive particles is observed which grows with A. No dependence on the target mass

number has been observed for the ratio of the dispersion and the mean multiplicity of negatively charged particles.

41826 **(JINR—E-1-81-289) Proton-helium elastic scattering from 45 to 400 GeV.** Buiak, A.; Devensky, P.; Jenkins, E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82701019.

The elastic proton-helium differential cross section has been determined for incident laboratory energies from 45 to 400 GeV in the range 0.003 <=|t'|<= 0.52 $(GeV/c)^2$ by means of the internal gas jet target technique. The differential cross section drops 4-5 orders of magnitude to the first dip at 't' approximately equal to 0.22 $(GeV/c)^2$. The shrinkage in the slope of the differential cross section is found to be twice as fast as that in the proton-proton case. The slope parameter at 't' approximately equal to 0 is described by the formula b=24+1.13 ln s. The elastic proton-helium cross section is normalized to the known elastic proton-proton cross section using data taken with a helium and hydrogen mixture as a target. The proton-helium total cross section is determined from the optical theorem. The total cross section rises by 4% between 100 GeV and 400 GeV. Results are presented on the real part of the elastic scattering amplitude and on the total elastic cross section. The experimental differential cross sections are compared to Glauber model predictions.

41827 **(JINR—E-1-81-436) Inelastic interactions of 4.5 GeV/c protons with emulsion nuclei not accompanied by relativistic charged particles.** Sumbera, M.; Vokal, S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701020.

Experimental results on proton-emulsion interactions without charged particles creation are presented and analysed. The role of this type of events though non-negligible at energies of several GeV decreases rapidly with increasing projectile energy. Except for broader multiplicity distribution of gray particles all other characteristics are similar to the case of multiple production. A comparison to the cascade evaporation model has been made and reasonable agreement has been found.

41828 **(JINR-R—1-12281) Multiplicity of secondary negative particles in nucleus-nucleus interactions at momentum of 4.2 GeV/c per nucleon.** Angelov, N.; Akhababyan, N.; Anoshin, A.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1979. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701024.

Experimental data on multiple production of π^--mesons in inelastic interactions of p, d, He, C relativistic nuclei with ^{12}C and ^{181}Ta nuclei at initial momentum P_0=4.2 GeV/c per nucleon are presented. The experiment is conducted by means of a 2 meter propane bubble chamber in the working volume of which three tantalum plates of 1 mm thickness have been places. Experimental data on AA-interaction are compared with general regularities for inelastic pp-interactions. The values of average multiplicities (nsub(-)) and multiplicity distribution dispersions Dsub(-) at the interaction of projectile nuclei with carbon and tantalum are presented. At is shown from the (nsub(-))/Dsub(-)sup(2) relation values that in the case of projectile light nuclei multiplicity distributions of π^- mesons almost do not differ from the poisson ones though a certain tendency to the (nsub(-))/Dsub(-)sup(2) relation decrease with the growth of the projectile nucleus atomic weight is observed. The conclusion is drawn that the average multiplicity depends mainly on the projectile nucleus atomic weight.

41829 **(MPI-PAE/EXP.EL.—89) Neutrino and antineutrino-nucleon scattering and perturbative quantum chromodynamics.** Schmitz, N. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). Jul 1980. 34p. (CONF-8006108—8). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82780454.

From 11. international symposium on multiparticle dynamics; Bruges, Belgium (22 Jun 1980).

The author gives a review about the experimental results concerning charged-current deep inelastic neutrino- and antineutrino-nucleon scattering. Furthermore, he compares the results with the predictions of quantum chromodynamics.

41830 **(RL—81-055) Limits on neutrino-antineutrino transitions from a study of high-energy-neutrino interactions.** Cooper, A.M.; Guy, J.G.; Michette, A.G.; Tyndel, M.; Venus, W. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Dec 1981. 7p. Rutherford and Appleton Lab., Chilton, Didcot, Oxfordshire, England.

We distinguish electron and positron tracks from nu/sub e/ and anti nu/sub e/ charged current interactions in a large bubble chamber filled with a neon-hydrogen mixture. No evidence is seen for an excess of anti nu/sub e/ interactions from primary anti nu/sub e/ sources or secondary nu/sub μ/ → anti nu/sub e/ or nu/sub e/ → anti nu/sub e/ osillations. Upper limits on oscillation parameters, majoron emission and lepton number violating π and K decays are presented.

41831 **Quark jets from deeply inelastic lepton scattering.** Orava, R. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Physica Scripta;* **25**: No. 1, 159-171(Jan 1982).

From Arctic School of Physics; Akaeslompolo, Finland (27 Jul - 7 Aug 1980).

Experimental evidence for flavored spin-1/2 quarks in the nucleon as probed by the electromagnetic and weak currents is reviewed. Recent data on Q^2 dependence of the nucleon structure functions are presented and discussed. Detailed structure of the hadron jets produced in deeply inelastic lepton-nucleon interactions is studied and evidence for the quark origin of the observed jets is presented.

41832 **Can 35 pionic mass intervals among related resonances be accidental.** Mac Gregor, M.H. (Lawrence Livermore Lab., CA). *Nuovo Cimento [Sezione] A;* **58A**: No. 2, 159-192(21 Jul 1980). Contract W-7405-ENG-48.

By analogy with the situation that occurs in nuclear physics, we might expect to find the lowest-mass hadronic state, the pion, serving as a fundamental hadron building block. In line with this conjecture, we find by a direct examination of the elementary-particle data that 35 pionic mass intervals, $\pi \cong 140$ MeV, are observed among groups of related resonances. These pionic mass intervals, which occur in the narrow-width and S-state resonances, involve 50 elementary-particle states, or approximately 80% of the observed narrow-width states in the energy regions under examination. In particular, accurate pionic mass intervals are observed among the very-low-mass pseudoscalar mesons, the very-high-mass upsilon mesons, the intermediate-mass (charmonium) mesons, the charmed and uncharmed kaon states, the baryon and dibaryon excitations, and even the masive leptons. The accuracy and the universality of this result indicate, irrespective of theory, that the pion serves in some manner as a basic mass quantum in the generation (and the decay) of elementary-particle states, although this pionic excitation quantum does not follow the quantum number assignments that are ascribed to free pions.

6452 Particle Interactions And Properties - Theoretical

41833 **(CEA-CONF—5737) PSI radiative decays and glueball.** Lacaze, R.; Navelet, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). Mar 1981. 5p. (CONF-810376—9). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700955.

From 16. rencontre de moriond: nonperturbative QCD: theory and experiment; Les Arcs, France (15 Mar 1981).

It is shown how perturbative QCD at lowest order can be successfully compared with the data for the inclusive J/PSI radiative decays. Our interpretation of the observed γ spectrum allows us to rule out the possibility of gluons having an effective mass and leads to the prediction that the observed E (1440) object has spin 0^-. In the 0^+ sector: glueballs around 1 GeV may contribute, as well as epsilon and S^* resonances. More accurate data on $\pi\pi$, KantiK and etaeta channels would allow to distinguish between these two possibilities for a 0^+ signal which is definitely required by the model.

41834 **(DOE/ER/00946—5) High energy hadron-hadron collisions. Annual progress report.** Chou, T.T. (Georgia Univ., Athens (USA). Dept. of Physics). Jan 1982. Contract AS09-76ER00946. 14p. NTIS, PC A02/MF A01. Order Number DE82011255.

Work on high energy hadron-hadron collisions in the geometrical model, performed under the DOE Contract No. DE-AS09-76ER00946, is summarized. Specific items that were studied last year include the dip movement in pp and anti pp elastic collisions, asymptotic behavior at very high energies for hadron-hadron collision, relation between dip structure in πp elastic scattering and the pion form factor, and pion-nucleus diffraction dissociation.

41835 **(IFVE-ONF/FTO/PK—80-144) Oscillation and CP violation in the "horizontal" superweak gauge scheme.** Monich, V.A.; Struminsky, B.V.; Volkov, G.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1980. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700957.

A model, in framework of which the CP violation processes and K^0 - anti K^0, D^0 - anti D^0... mixing are caused by "horizontal" gauge weak interactions is considered. Spontaneous CP violation is provided by introducing the Higgs multiplets belonging to adjoint representation of the SUsup(H)(2)sub(L(R)) group. Possible contributions of the "horizontal" interactions into the values of mixing and CP violation parameters are calculated. It is emphasized that the effective strength of "up"-"down" symmetry breaking by the "horizontal" interactions is less than by the standard weak interactions.

41836 **(IFVE-OTF—81-85) Quadrupole transition $\Delta \rightarrow$ Nsub(γ) in Quark model.** Gershtein, S.S.; Dzhikiya, G.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700959.

A quadrupole moment of $\Delta \rightarrow$Nsub(γ) transition arising due to tensor QCD-interaction has been calculated in the framework of constituent k model. quark model. The procedure of Δ and N wave function calculation is presented in full detail. The wave functions are used to estimate E_1^+ i M_2^+ amplitudes of resonance photoproduction reaction $\gamma N \rightarrow \Delta \rightarrow \pi N$ and to calculate quadrupole moments for different charge state of Δ.

41837 **(IFVE-OTF—81-115) Sterman-Weinberg formula in deep inelastic scattering.** Dzhaparidze, G.Sh.; Kartvelishvili, V.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700958.

The jet cross-section in current fragmentation region in deep inelastic scattering is obtained. It is shown that this jet produced in ep reaction is narrower, then the one from e^+e^--annihilation.

41838 **(ITEF—87(1980)) Quantum chromodynamics-vacuum and phenomenology of "old" mesons.** Vainshtein, A.I.; Zakharov, V.I.; Novikov, V.A.; Shifman, M.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1980. 72p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82700960.

The existing ideas on quantum chromodynamics vacuum lead to some non-trivial results for "old" mesons -particles constructed from u, d, s-quarks and (or) gluons without heavy quarks participation. A new classification of hadrons is suggested: by the character of interaction of quark and gluon constituents with vacuum fields. It appears that this interaction is not of universal character and substantially changes from hadron to hadron. In the bag model language this means the "bag constant" B depends on quark (gluon) hadron content and its quantum numbers. The relation to vacuum fields is characterized by a certain latent P parameter. The introduction of this parameter gives quantitative sense to quark-hadron and gluon-hadron duality. Duality intervals have been found in various channels. For example, in the O^- gluon channel it appears to be great, approximately 6 GeV. The hadron phenomenology regularity is naturally explained. Zweig rule approximated SU (6) symmetry etc. Gluons are discussed in detail. Gluon states masses with various quantum numbers are estimated. A new formula for eta-meson mass is obtained.

41839 **(WIS-Ph—81/40) Minimal flavor unification via multigenerational Peccei-Quinn symmetry.** Davidson, A.; Wali, K.C. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Aug 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700784.

While maintaining the elementary nature of SU(5) and/or SO(10), a unique physical correlation is established among the Peccei-Quinn symmetry, flavor unification and the canonical Fritzsch-type fermionic mass structure. The effects of a global versus a local horizontal symmetry on the mass matrix are analysed, and a conjecture is made, using that mechanism which takes care of the axiom concerning the origin of weak CP-violation. A possible bridge to composite models is noted.

41840 **e^+e^- physics today and tomorrow.** Perl, M.L. (Stanford Linear Accelerator Center, CA (USA)). *Physica Scripta;* **25**: No. 1, 172-190(Jan 1982).

From Arctic School of Physics; Akaeslompolo, Finland (27 Jul - 7 Aug 1980).

The author discusses the following topics: the parameters of e^+e^- storage rings which are directly relevant to experiments; the physics of e^+e^- one-photon-exchange as illustrated by the reaction $e^+e^- \rightarrow \mu^+\mu^-$; the naive quark model for the reaction $e^+e^- \rightarrow$hadrons; the status of the tau lepton; the status of the search for heavier leptons; the non-relativistic quantum mechanics of heavy quark-antiquark systems - the psi/J particle family and the UPSILON particle family. Finally the author considers the situation as e^+e^- colliding beams machines attain very high energy, >approximately 50 GeV, e^+e^- annihilation will occur through the weak interactions as well as through the electromagnetic interaction. This will allow the study of the weak interactions and the study of any new particles related to, or produced through, the weak interactions. The author discusses this physics at an energy corresponding to the mass of the Z^0 intermediate boson, assuming the Z^0 exists; and then discusses the physics at yet higher energy. He concludes with a description of the capabilities and limitations of the e^+e^- colliding beams machines needed to attain this very high energy - both storage rings and colliding linear accelerators.

41841 **States of baryonium within the hadron family.** Chew, G.F. (Service de Physique Theorique, Saclay, France). pp 515-524 of Antinucleon-nucleon interactions. Ekspong, G.; Nilsson, S. (eds.). Oxford, England; Pergamon Press (1977).

Duality arguments for the existence of baryonium states are reviewed and related to the baryon-antibaryon potential model. After a discussion of qualitative features anticipated for the baryonium spectrum, present experimental indications are compared to theoretical expectations.

6453 Particle Invariance Principles And Symmetries

41842 **(BONN-HE—81-11) Bosonic contruction of the Lie algebras of some non-compact groups appearing in supergravity theories and their oscillator-like unitary representations.** Guenaydin, M.; Saclioglu, C. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jun 1981. 20p. Bonn Univ. (Germany, F.R.). Physikalisches Inst.

We give a construction of the Lie algebras of the non-compact groups appearing in four dimensional supergravity theories in terms of boson operators. Our construction parallels very closely their emergence in supergravity and is an extension of the well-known construction of the Lie algebras of the non-compact groups Sp(2n,IR) and So(2n)sup(*) from boson operators transfoming like a fundamental representation of their maximal compact subgroup U(n). However this extension is non-trivial only for $n >= 4$ and stops at $n = 8$ leading to the Lie algebras of SU(4) x SU(1,1), SU(5,1), SO(12)sup(*) and $E_{7(7)}$. We then give a general construction of an infinite class of unitary irreducible representations of the repective non-compact groups (except for $E_{7(7)}$ and SO(12)sup(*)

obtained from the extended construction). We illustrate our construction with the examples of SU(5,1) and SO(12)sup(*).

41843 **Electroweak interactions.** Bjorken, J.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Physica Scripta;* **25**: No. 1, 69-85(Jan 1982).

From Arctic School of Physics; Akaeslompolo, Finland (27 Jul - 7 Aug 1980).

The author presents a point of view of the electroweak interaction which begins phenomenologically and moves in stages toward the conventional gauge theory formalism containing elementary scalar Higgs-fields and then beyond. The purpose in so doing is that the success of the standard SU(2)xU(1) theory in accounting for low energy phenomena need not automatically imply success at high energies.

6454 Field Theory

REFER ALSO TO CITATION(S) 41838

41844 **(DOE/ER/70004—321) Constraints among structure functions.** Hwa, R.C.; Zahir, M.S. (Oregon Univ., Eugene (USA); Victoria Univ., British Columbia (Canada). Dept. of Physics). Nov 1981. Contract AT06-76ER70004. 13p. NTIS, PC A02/MF A01. Order Number DE82008493.

It is shown that a simple constraint between F_2/sup μn//F_2/sup μp/ and F_2/sup νp//F_2/sup μp/ derived from the basic properties of QCD that are contained in the quark-parton model is not satisfied by the present experimental data. The measurement of semi-inclusive cross sections that may clarify the issue on d/u ratio is suggested.

41845 **(WIS-Ph—81/50) Mean field theory for lattice gauge systems with fermions.** Horsley, R. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). Sep 1981. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700785.

We extend recent mean field calculations for lattice gauge theories to include fermions. We find that the addition of a Wilson fermion leads to an almost negligible change of the weak to strong coupling transition point. The plaquette average is also only weakly affected.

65 PHYSICS RESEARCH

41846 **(ZfK—443) Joint annual report 1980.** Hohmuth, K. (ed.). (Bergakademie Freiberg (German Democratic Republic). Sektion Physik; Friedrich-Schiller-Universitaet, Jena (German Democratic Republic). Sektion Physik; Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Physik; Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik; Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). May 1981. 287p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE81701038.

Results of research work carried out at the ZfK Rossendorf in 1980 are presented in individual summaries covering the following topics: nuclear reactions, nuclear spectroscopy, nuclear theory, applied methods of nuclear physics, accelerators, nuclear electronics and methods, and computer codes. A list of publications is included.

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 40922, 41302

41847 **(AERE-PR/NP—28) Nuclear Physics division progress report. For the period 1st January to 31st December 1980.** Lees, E.W.; Longworth, G.; Scofield, C.J. (eds.). (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Jul 1981. 126p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE82700792.

Work undertaken by the Nuclear Physics Division of AERE, Harwell during 1980 is presented under the headings: (1) Nuclear Data and Technology for Nuclear Power. (2) Nuclear Studies. (3) Applications of Nuclear and Associated Techniques. (4) Accelerator Operation, Maintenance and Development. Reports, publications and conference papers presented during the period are given and members of staff listed.

41848 **(INIS-mf—6800) Annual Report 1980.** (Rijksuniversiteit Utrecht (Netherlands). Robert van de Graaff Lab.). 1981. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82780402.

The activities of the laboratory during 1980 are presented in a series of reports. Research has been performed with the tandem accelerator into nuclear structure, heavy-ion reactions and the systematics of transient fields and with the 3MV accelerator into capture reactions and precision calibration of gamma-ray energies. Further details are given of advances in thermal neutron capture, shell-model calculations, statistical methods, ultra sensitive mass spectrometry and radionuclides in medicine. (C.F.).

6512 Nuclear Properties And Reactions, A=1-5

REFER ALSO TO CITATION(S) 41826

41849 **(JINR—1-81-530) Topological cross sections of ^{3}Hep interactions at 13.5 GeV/c momentum of ^{3}He.** Busdavina, N.A.; Golovachev, V.V.; Dirner, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701017.

The 1 m hydrogen bubble chamber of JINR was exposed to a 13.5 GeV/c ^{3}He beam obtained by means of stripping reactions in collisions of accelerated ^{4}He nuclei with a plexiglass target. Topological effective cross sections of ^{3}Hep-interactions as well as the yields of negative pions and deuterons were estimated. The negative pion and deuteron production effective cross sections are equal to (30.4+-0.5) mb and (35.5+-2.0) mb, respectively. The systematic errors are found to be within 2%.

6513 Nuclear Properties And Reactions, A=6-19

REFER ALSO TO CITATION(S) 41823, 41824, 41825, 41827, 41828

41850 **(JINR-R—1-80-780) Study on the ^{7}Li(p,pd)^{6}He reaction at 670 MeV.** Koncz, P.; Seres, Z.; Fodor, Z.; Ero, J.; Krumshtein, Z.V.; Merekov, Yu.P.; Petrukhin, V.I.; Khovanskii, N.N.; Khomenko, B.A.; Csatlos, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1980. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701025.

The ^{7}Li(p, pd)^{6}He reaction was investigated in coincidence experiment at large-angle quasi-free scattering geometry. The aim of the study was to get information about quasideuteron associations in the ^{7}Li nucleus indicating clear ^{4}He-^{3}H cluster structure. Deuterons emitted at the angle of 6.5 deg were analyzed in momentum by a magnetic spectrometer and identified by their times of flight. A total absorption scintillation spectrometer detected protons at the angles of 147 and 110 deg. Transitions to the ground state and highly excited state of the ^{5}He residual nucleus have been observed. Energy distribution of scattered protons agree with theory of the quasi-free scattering on quasideuterons in the p- and s-shells of the ^{7}Li nucleus.

41851 **(JINR-R—1-80-863) Study on the $^{12}C(p,2p)^{11}B$ reaction at 450 MeV energy and estimation of proton momentum distribution in the ^{12}C nucleus in the 35-560 MeV/c range.** Veg, L.; Zul'karneev, R.Ya.; Kutuev, R.Kh.; Murtazaev, Kh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1980. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701026.

The rho(k) momentum distribution has been obtained by analysing the measured differential cross section of the $^{12}C(p, 2p)^{11}B$ reaction at T=450 MeV/c in a nonsymmetric coplanar geometry summing over all the final states of the residual nucleus. The scattered and knocked out protons have been detected by two telescopes, in each of which the time-of-flight and particle energy have been measured thus permitting to perform a reliable particle idenfication. The secondary particle energy spectra have been measured in 120-210 MeV and 240-330 MeV ranges at 11 values of the angle between the telescopes in the 81-142 deg l.s. interval. The rho(k) function analysed in terms of the plane wave impulse approximation taking into account the off-mass-shell effect, can be described by conventional Gaussian form in the region of small moments (30-250) MeV/c. The behaviour of rho(k) in the region of large K momenta (250-600) MeV/c corresponds to exponential character. The effect of absorption and rescattering effect inside the nucleus can not effect considerably the form of rho(k).

41852 **(JINR-R—1-81-79) Interaction cross sections of secondary multicharged fragments of carbon relativistic nucleus with propane.** Agakishiev, G.A.; Akhababyan, N.; Baatar, Ts. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700799.

Experimental values have been obtained of inelastic cross sections for interactions of secondary spectator fragments with charge z/sub f/ = 2, 3, 4, 5, 6 produced in collisions of carbon relativistic nucleus in propane (C_3H_8). Within experimental errors, no significant increase is observed of the interaction cross section of the spectator fragments at a distance of about 10 cm from the fragment source in comparison with the expected one. Some methodical questions are considered which are connected with a search for relativistic nucleus excitations using bubble chamber technique.

41853 **Neutron total and scattering cross sections of ^6Li in the low-MeV range.** Smith, A.B.; Guenther, P.T.; Whalen, J.F. (Argonne National Lab., IL (USA)). *Nuclear Physics* [*Section*] *A;* **373**: No. 2, 305-325(11 Jan 1982).

Neutron total cross sections of ^6Li are measured at intervals of approx. <= 10 keV from approx. equal to 0.1 to 4.8 MeV with precisions of approx. equal to 1 to 3%. Differential elastic scattering cross sections are measured at intervals of approx. <= 100 keV from 1.5 to 4.0 MeV at 10 or more scattering angles distributed between the approx. equal to and 160 deg. Differential inelastic scattering cross sections are measured at selected angles in the energy range 3.5 to 4.0 MeV. The experimental results are analyzed in terms of R-matrix theory and the model parameters used to deduce the $^6Li(n,\alpha)$ cross sections. The implications of the measurements and their interpretation on the level structure of ^7Li and the reaction mechanisms are discussed.

41854 **Light particle emission from reactions of 208 MeV ^{16}O ions with ^{12}C, ^{56}Fe, and ^{91}Zr.** Fulmer, C.B.; Ball, J.B.; Ferguson, R.L.; Robinson, R.L.; Wu, J.R. (Oak Ridge National Lab., TN (USA)). *Physics Letters,* [*Section*] *B;* **100**: No. 4, 305-309(9 Apr 1981).

Energy spectra and yields were measured for p, d, t, ^3He and α particles from reactions of 13 MeV/A ^{16}O ions with targets of ^{12}C, ^{56}Fe, and ^{91}Zr. For each of the ejectiles, the energy spectra extend significantly above the energy/nucleon of the incident projectile and vary only slowly with target mass.

6515 Nuclear Properties And Reactions, A=39-58

REFER ALSO TO CITATION(S) 41854, 41858, 41872

41855 **(INIS-mf—6805) Transfer reactions on ^{58}Ni and ^{56}Fe induced by polarized protons of 25 MeV.** Polane, J.H. (Technische Hogeschool Eindhoven (Netherlands)). 5 Jun 1981. 112p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE82780323.

Thesis.

This thesis deals with several types of transfer reactions which were induced by bombarding ^{58}Ni and ^{56}Fe foils, respectively, with a beam of polarized protons having an energy of 24.6 MeV. Three types of reactions have been studied; the transfer of one neutron (p,d), the transfer of two neutrons (p,t) and the transfer of two neutrons and one proton (p,α). The purpose of this study was twofold, namely the extension of the spectroscopic knowledge of the nuclei ^{57}Ni and ^{55}Fe - by means of the (p,d) reactions - and the determination of the importance of multistep processes for all reactions investigated in this thesis.

41856 **Missing Gamow-Teller strength in mass 42.** Goodman, C.D.; Foster, C.C. (Indiana Univ., Bloomington (USA)); Bainum, D.E. (Emporia State Univ., KS (USA)); Bloom, S.D. (California Univ., Livermore (USA). Lawrence Livermore National Lab.); Gaarde, C.; Larsen, J. (Niels Bohr Inst., Copenhagen (Denmark)); Goulding, C.A. (Los Alamos National Lab., NM (USA)); Horen, D.J. (Oak Ridge National Lab., TN (USA)); Masterson, T. (Colorado Univ., Boulder (USA)); Grimes, S. (Ohio Univ., Athens (USA)). *Physics Letters,* [*Section*] *B;* **107**: No. 6, 406-411(31 Dec 1981).

The reaction $^{42}Ca(P,n)^{42}Sc$ at Esub(P) = 160 MeV is used to measure the Gamow-Teller (GT) strength function. Normalization of the dominant peak in the (p,n) spectrum to B(GT) determined from the analogous transition in the beta decay of ^{42}Ti renders the strength function absolute, and the total measured strength is about half of the minimum value required for a T = 1 nucleus. Shell model calculations are presented which reproduce the shape of the strength function, but overpredict the absolute measured strength by about a factor of two. Evidently the missing strength has been moved out of the region of nucleon paricle-hole excitations, and quenching, due possibly to Δ33 coupling, is indicated. Symmetry implications of an observed strong suppression of the Tsub(>) component of the GT strength are discussed.

6516 Nuclear Properties And Reactions, A=59-89

41857 **(JINR—1-81-329) Search for shock waves in central interactions of carbon nuclei with copper and lead nuclei at 4.5 GeV/c per nucleon.** Anikina, M.Kh.; Vardenga, G.L.; Golokhvastov, A.I.; Lukstynysh, Yu.; Okonov, E.O.; Pol, Yu.S.; Taran, G.G.; Khorozov, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701016.

Experimental data on angular distributions of secondaries in central interactions of carbon nuclei (4.5 GeV/c per nucleon) with copper and lead nuclei are given. Experiment was carried out on incident beam of synchrophasotron. Secondary particles are detected with counters. Angle between the axis of these counters and beam directions varies from 15 to 90 degrees. Target was oriented relative to the beam so, that absorption of particles in it escaping at an angle of 60 degrees may be minimum. This position does not change during measurements. Target thicknesses are the following: copper - 0.92 mm, lead -1.0 mm. At the 3-5% accuracy of measurements within 15-90 deg angle range to the beam direction no anomaly in angular distribution has been discovered which could serve as an evidence of shock wave appearance.

41858 (JINR—E-15-80-444) Probability of the reaction (πp,p) and the existence of Δ-isobars in the atomic nucleus. Abazov, V.M.; Butsev, V.S.; Chultem, D.; Gavrilov, Yu.K.; Kurepin, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1980. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700798.

The process of slow π^- absorption in the $_{21}{}^{45}$Sc, $_{27}{}^{59}$Co, $_{39}{}^{89}$Y, $_{55}{}^{133}$Cs, $_{59}{}^{141}$Pr and $_{79}{}^{197}$Au atomic nuclei, followed by the emission of one proton was investigated with the use of the activation technique. Experiments were carried out at a pion beam with the energy about 680 MeV, focused onto a copper target which served as the source of slow negative pions. Then Esub(π)=30 MeV pions were focused onto the investigated target by a wide angle solenoidal lens. The γ-radiation studies were performed using spectrometers consisting of Ge(Li) detectors of different volumes. The series of the γ-ray spectra of the isotopes under investigation were transfered to a BESM-6 computer for subsequent treatment using standard programmes. The probabilities of single proton emission have been determined from the yields of the isotopes produced. The following values are obtained, per stopped pion: $W<=6.1x10^{-4}$ for the reaction $_{21}{}^{45}Sc(\pi^-, p)\ _{19}{}^{44}K$; $W<=0.87x10^{-4}$ for the reaction $_{27}{}^{59}Co(\pi^-, p)_{25}{}^{58}Mn$; $W<=6.9x10^{-4}$ for the reaction $_{39}{}^{89}Y(\pi^-, p)_{37}{}^{88}Rb$; $W<=1.3x10^{-4}$ for the reaction $_{55}{}^{133}Cs(\pi^-, p)_{53}{}^{133}I$; $W<=3.0x10^{-4}$ for the reaction $_{59}{}^{141}Pr(\pi^-, p)_{57}{}^{140}La$; and $W<=3.3x10^{-5}$ for the reaction sub(79)sup(197)Au(πsup(-), p)sub(77)sup(196m)Ir. The results of probabilities obtained yield the upper limit for the probability of the existence of the Δ^{++} isobar on the nuclear surface at a lower level of 10^{-4}-10^{-5} which can probably be accounter for by a smaller contribution from multiple processes occurring in the reaction investigated. It is possible to conclude that the probability of single proton evaporation from a nucleus with an energy of the order of 20 MeV lies at a level of about 10^{-2}.

41859 (WIS-Ph—81/27) G-factor of the 8^+ yrast level in ^{84}Sr via a tilted multi-foil experiment. Broude, C.; Dafni, E.; Gelberg, A.; Goldberg, M.B.; Goldring, G.; Hass, M.; Zemel, A.; Kistner, O.C. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). May 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700801.

The g-factor of the 8^+ yrast level of ^{84}Sr has been measured using the polarized hyperfine fields of a tilted multi-foil target. The sign of the g-factor has been determined to be negative to better than six standard deviations. Calibration using similar measurements on levels in ^{77}Se and ^{80}Se ion yields the value of g=-0.15(7), indicating a νgsub(9/2)sup(-4) configuration for this level.

41860 Thermal and resonance neutron capture studies in Se targets with A = 74, 77, 78, 80. Engler, G.; Chrien, R.E.; Liou, H.I. (Brookhaven National Lab., Upton, NY (USA). Physics Dept.). *Nuclear Physics [Section] A;* **372**: No. 1/2, 125-140(Dec 1981).

Thermal and resonance neutron capture γ-ray measurements have been performed on a natural Se target. Accurate energies and absolute intensities of primary and secondary γ-rays for thermal and resonance capture were measured for ^{74,75,77,78,80}Se. Neutron separation energies derived from thermal measurements for the following are 8027.5 +- 0.4 keV for ^{75}Se[^{74}Se + n]; 7418.8 +- 0.2 keV for ^{77}Se[^{76}Se + n]; 10497.8 +- 0.3 keV for ^{78}Se[^{77}Se + n]; and 6701.1 +- 0.6 keV for ^{81}Se[^{80}Se + n]. Ten resonances were analyzed and their spins and parities were determined or confirmed as $1/2^+$ for the 27.1 eV and 271.5 eV resonances in ^{74}Se, and for the 377.0 eV and 862 eV resonances in ^{76}Se; 1^- for 112.0 eV, 0^- for 211.6 eV, 1^- for 340.8 eV and (1^-) for 864.0 eV resonances in ^{77}Se; $1/2^+$ for the 383.0 eV resonance in ^{78}Se and ($3/2^+$) for the 1970 eV resonance in ^{80}Se. From the resonance data assignments of possible spins and parities of 20 levels in ^{75,78,79}Se were made. E1 strength functions for thermal capture in ^{74,76,77}Se and for the 27.1 eV resonance in ^{74}Se were calculated for both single-particle and giant dipole resonance models and seem to conform to the systematics in the Se mass region. Indications of non-statistical effects in thermal and resonance neutron capture were seen from the anomalous strength of the 7734.0 keV transition to the $1/2^-$ 293.1 keV state in ^{75}Se. This is supported by the single-particle nature of the 293.1 keV state as is evident form a large (d,p) l = 1 spectroscopic factor to this state. The valence model for direct neutron capture mechanism does not, however, account for the effect.

6517 Nuclear Properties And Reactions, A=90-149

REFER ALSO TO CITATION(S) 41819, 41820, 41825, 41854, 41858, 41879

41861 (JINR—E-1-81-156) Hadron-nucleus collisions. Pt. 3. Produced particle multiplicities, energy and angular spectra, pseudorapidity distributions. Strugalski, Z. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700208.

It is shown how it is possible to account for hadron-nucleus data on particle multiplicity distributions and pseudorapidity distributions in terms of our knowledge of hadron-nucleon collisions, nuclear sizes and nucleon density distributions in nuclei. Corresponding formulas are derived and tested. Expressions, describing energy and angular spectra of produced particles, are derived as well.

41862 (JINR-D—3-81-480) Experimental investigation of parity violating effect in the ^{117}Sn neutron p resonance. Alfimenkov, V.P.; Borzakov, S.B.; Vo Van Thuan; Mareev, Yu.D.; Pikelner, L.B.; Rubin, D.; Khrykin, A.S.; Sharapov, E.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1981. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701018.

The results of measurements of the difference of the total cross sections in neutron reactions on ^{117}Sn nuclei at 1.33 eV p resonance for positive- and negative-helicity neutrons are presented. The parity nonconservation effect in the ^{117}Sn p resonance is observed. The ratio of the difference of cross sections with contrary helicities (tausub(+)-tausub(-)) to the sum(tausub(+)+tausub(-)) in the resonance is found to be equal to $(4.5+-1.3)x10^{-3}$.

41863 (JINR-R—3-81-144) Statistical analysis of the alpha particle yield from the (n,α) reaction on resonance neutrons. Andrzeiewski, J.; Becvar, F.; Vo Khim Tkhan; Vtyurin, V.A.; Popov, Yu.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700794.

The method of "mathematical experiment" (Monte-Carlo method) was used for the analysis with statistical model of the nucleus of α-particle→from the (n, a) reaction. The results were compared with experimental data on ^{147}Sm (n, a)^{144}Nd reaction at several neutron energies. It was shown that in a-decay of the compound nucleus of ^{148}Sm with a confidence of approximately 99.92% there appears a weak enhancement (approximately 30%) of reduced probabilities of a-transitions into one-, two-phonon states of the daughter nucleus.

41864 (JINR-R—3-81-432) Effect of odd nucleon of the target-nucleus of neutron p-scattering. Aleksandrov, Yu.A.; Nikolaenko, V.G.; Popov, A.B.; Samosvat, G.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1981. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701028.

The relations of neutron p- and s-scattering amplitudes on 116, 117, 118, 119, 120, 122 and 124 tin isotopes are measured in the 1 upto 60 keV energy range. All the relations lie on one smooth curve with respect to A. The results are compared with earlier observed jumps of such relations for a number of odd Z-nuclei. A possibility of appearing here one-pion exchange between an incident neutron and odd proton of target-nucleus is discussed.

41865 (JINR-R—3-81-433) Study on the ^{143}Nd(n,γα)^{140}Ce reaction on resonance neutrons and multipolarity of γ-transitions between compound states. Andreiewski, J.; Vo Khim Tkhan; Vtyurin, V.A.; Popov, Yu.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1981. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701029.

The ^{143}Nd(n, γa)^{140}Ce reaction on resonance neutrons was investigated by the time-of-flight method at the IBR-30 pulse reactor. The width of the resonance with spin 4⁻ at E_0=55 eV was GITAsub(γa)=0.089+-0.017 μeV and at E_0=159 eV was GITAsub(γa)=0.087+-0.024 μeV. The ratio of widths of resonances with spin 4⁻ and 3⁻ (on thermal neutrons) gave the radiative strength functions for the γ-transitions between compound states with multipolarity E1 and M1 to be equal to Ssub(γ)sup(cc)(E1)=(8+-3)x10sup(-9) MeV⁻³ and Ssub(γ)sup(cc)(M1)=(7+-3)x10sup(-9) Mev⁻³. This confirms the earlier established fact of the large contribution of M1 multipolarities into γ-transitions between the compound states. But still one cannot neglect the contribution of E1 multipolarity.

41866 (PB—81-247330) Coincidence measurements with high energy electrons. Final report. O'Connell, J.S. (National Bureau of Standards, Washington, DC (USA)). 1981. 10p. Proceedings of the Workshop on Nuclear Physics with Real and Virtual Photons held at Bologna, Italy on November 25-28, 1980, Paper in From Collective States to Quarks in Nuclei, p286-295 1981.

This talk surveys reactions of the type A(e,e'x) where x is a nucleon, two nucleons, pion, nucleon plus pion, or a photon. At high energy and momentum transfer, phenomena are studied that influence classical nuclear physics, but which have not yet been measured or theoretically understood. The interplay between measurement techniques, experimental feasibility, and theoretical interpretability is stressed. A number of examples are given of counting rates for specific measurements with continuous duty factor electron beams with energies between 500 and 3000 MeV.

41867 (WIS-Ph—81/44) Isoscalar E3 strength distributions in even-even nuclei. Kirson, M.W. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Aug 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700796.

Systematic experimental data on nuclear octopole strength is explained by a simple extension of the standard schematic model. The strength is shared equally by the lowest 3⁻ state and two giant resonances. A similar structure is suggested for higher electric multipoles.

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 41295, 41828

41868 (JINR—1-80-778) Estimation of corrections to multiplicity of πp - mesons produced in the interaction of light relativistic nuclei with tantalum target. Gasparyan, A.P.; Gulkanyan, G.R.; Korchagin, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1980. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701013.

Some correlations to the PI⁻ -multiplicities due to secondary interactions in thin tantalum targets of approximately 1 mm placed inside the 2 m propane chamber irradiated by relativistic protons, deuterons, helium and carbon nuclei are considered. The distortions are caused mainly by non-identified electrons from converted in tantalum plates γ-quanta and slow PI⁻ -meson absorption inside the targets. Summary corrections make up approximately 2.5+-sub(1.7)sup(3.0)%. Due to methodical distortions the accuracy of determination of average multiplicity of PI⁻ -mesons in nucleus-nuclear interactions is limited up to 5%.

41869 (JINR—E-15-81-273) Probability of single-nucleon emission in πp capture reactions on the ^{152}Sm and ^{164}Dy nuclei. Butsev, V.S.; Gavrilov, Yu.K.; Kurepin, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701021.

The process of single-nucleon emission in π^- capture reactions on the ^{152}Sm and ^{164}Dy nuclei has been investigated. The upper limit of single-proton emission in the reaction ^{152}Sm(π^-, p)^{151}Nd has been determined to be at a level of (3-4)x10⁻⁴ per stopped negative pion. The probabilities of single-neutron emission in the reactions ^{152}Sm(π^-, n)^{151}Pm and ^{164}Dy(π^-, n)^{163}Tb are determined to be at a level of (2.5+-0.9)x10⁻³ and (1.3+-0.8)x10⁻³ per stopped π^-, respectively. The upper limit of the ratios of reaction cross sections $\sigma(\pi^-, p)/\sigma(\pi^-, n)$ has been set at 0.14.

41870 (JINR-R—7-80-666) Study on the reactions with the alpha particle escape. Brukhertzaifer, Kh.; Langrok, E.; Muzychka, Yu.A.; Oganesyan, Yu.Ts.; Pavlat, T.; Penionzhkevich, Yu.E.; Pustyl'nik, B.I.; Shilling, K.D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1980. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701030.

The excitation functions of the reaction sup(176)Lu(sup(22)Ne, αxn)sup(194-x)Au have been experimentally studied. Identifying and determining gold isotopes yields have been conducted by means of a gamma spectrometer with the Ge(Li) detector with the 70 cm³ effective volume by characteristic gamma transitions of corresponding nuclides. Determining cross sections of gold isotope production from experimentally measured gamma spectra has been carried out basing on two assumptions: on direct production of gold isotopes as a result of αxn reactions and their cumulative production in xn reactions. The cross sections obtained on the base of two assumptions do not differ within the limits of the accuracy of the experiment. For the energy range above 160 MeV it has been considered that the gold isotopes are mainly produced as a result of αxn reactions. It has been shown that for the ion .. energy above 5 MeV/nucleon αxn reactions with x equaling 0, 1, 2, 3 proceed with a noticeable cross section. On the base of the obtained experimental excitation functions of αxn reactions and their analysis the following conclusions can be drawn. Observation of ^{194}Au nuclei in the reaction ^{22}Ne+ ^{176}Lu testifies to the fact that the escape of the high energy particle takes place with a certain probability which practically carries away the whole thermal energy of the residual nucleus. From the ^{22}Ne ion energy >=140 MeV the basic contribution is made by the reactions with direct energetic α particle emission and subsequent neutron evaporation. After the fast α particle escape the compound nucleus remains in the state with a mainly large angular moment. The estimate of the maximum angular momentum of this compound nucleus gives the value l approximately 60-70 $\hbar/2\pi$ for energies of ^{22}Ne ions from 180 to 215 MeV.

6519 Nuclear Properties And Reactions, A=190-219

REFER ALSO TO CITATION(S) 41857, 41858, 41876

41871 (DOE/ER/03122—1) Final technical report. (Columbia Univ., New York (USA). Dept. of Chemistry). 1982. Contract AS02-76ER03122. 3p. NTIS, PC A02/MF A01. Order Number DE82008817.

Nuclear reactions were studied between 724 MeV ^{86}Kr and ^{197}Au. The production of H and He was used to probe the dynamics of the interaction of these heavy ions under conditions of large energy dissipation and large incident angular momenta. Measurements of energy spectra and angular distributions are presented for /sup 1,2,3/H and ^{4}He in the singles mode. The total cross sections of ^{1}H or ^{4}He indicated that approximately 1/3 of the reactions produced ^{1}H and approximately 1/3 of the reactions produced ^{4}He. At backwards angles, the ^{4}He energy spectra in the center of mass (cm) suggested the presence of (at least partially) equilibrated emission from the composite system. The singles ^{1}H and ^{4}He angular distributions were found to be somewhat forward peaked in the cm, and this effect was qualitatively different from the angular distributions of direct ^{4}He in the reactions of first-row elements with very heavy targets.

41872 (JINR—E-7-81-109) Regularities of deep inelastic transfer reactions with the ^{40}Ar projectile. Popescu, A.; Popescu, D.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1981. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701023.

From the analysis of experimental data available on heavy ion reactions induced by the ^{40}Ar projectile, new regularities of the

cross sections of light nuclei were obtained. The factor of the THETASub(gg) dependence is found to behave exponentially with the Z of light nuclei. New isospin systematics of cross sections for deep inelastic transfer reactions are proposed.

6520 Nuclear Properties And Reactions, A=220 And Above

REFER ALSO TO CITATION(S) 41174

41873 **(KIYI—80-14) Some characteristics of ^{235}U, ^{237}Np, ^{238}U photofission in the giant resonance range.** Ganich, P.P.; Sikora, D.I. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1980. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82701031.

Partial fissilities cross section ratio for symmetric and asymmetric photofission and difference of potential energies for symmetric and asymmetric deformation of ^{235}U, ^{237}Np, ^{238}U nuclei at gamma quantum energies in the giant resonance range up to 18 MeV are determined. Partial fissility corresponding to one of the most probable channels of asymmetric photofission, remains practically constant over the whole giant resonance range. The partial channel fissility of symmetric fission increases with gamma quanta energy growth. Potential energies differences have a tendency to decrease while gamma quanta energy increases. It is concluded that at gamma quanta energies in the giant resonance range though an increase of fissility symmetric component is observed, shell effects play an important part in forming mass distributions of ^{235}U, ^{237}Np, ^{238}U photofission fragments.

41874 (NEANDC(E)—212U(v.5), pp 14-15) **Neutron capture and fission cross section of ^{241}Am in the energy range from 10 to 250 kev.** Wisshak, K.; Kaeppeler, F. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Kernphysik 2). Jun 1980. Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

In Progress report on nuclear data research in the Federal Republic of Germany. For the period April 1, 1979 to March 31, 1980.

41875 **Maximum liklihood method applied to the problem of multi-component decay.** Eggers, R.C.; Somerville, L.P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Instruments and Methods in Physics Research;* **190**: No. 3, 535-541(15 Dec 1981).

A method of multi-component decay analysis is presented using the maximum likelihood method instead of the least-squares method. The maximum likelihood method has been applied to the analysis of fission track data from experiments designed to produce elements 104-107, and has resulted in the best possible half-life estimates from data having only a few counts. It may also be applied to other cases where there are insufficient numbers of counts to make collection of data into time bins and least-squares analysis a valid procedure. The formulas for asymmetric error bars in the multi-component case are developed along with example computations.

41876 **Properties of the extended ground rotational bands in actinide even-even nuclei.** Peker, L.K.; Pearlstein, S. (Brookhaven National Lab., Upton, NY (USA). National Nuclear Data Center); Hamilton, J.H. (Vanderbilt Univ., Nashville, TN (USA). Dept. of Physics). *Physics Letters, [Section] B;* **100**: No. 4, 281-284(9 Apr 1981).

The energies of the yrast levels extending up to I = 28 in even-even actinide nuclei were analyzed in terms of an angular velocity expansion Esub(rot)(I) = Σsup(n)sub(i = 1) $a$sub(i)ω^2sup(Isub(i)) with n = 2-7 to test the application of this expansion to high spin. A strong ω^2-dependence is observed for the Variable Moment of Inertia model (VMI) with two parameters $a$sub(i)(ω^2), particularly at the higher spins. There is marked difference in the ω^2-dependence of these parameters between the N = 142 and other nuclei studied in this region to indicate structure effects are present at the higher spin.

6530 Nuclear Theory

41877 **(JINR—E-4-80-735) Classical statistical model of heavy ion collisions. Part 2. Description of the computer code TRAJEC.** Schmidt, R.; Teichert, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1980. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700793.

The use of the computer code TRAJEC which represents the numerical realization of a classical statistical model for heavy ion collisions is described. The code calculates the results of a classical friction model as well as various multi-differential cross sections for heavy ion collisions. INPUT and OUTPUT information of the code are described. Two examples of data sets are given.

41878 **(JINR-R—4-81-134) Algebraic two-vector-boson model of collective motion in nuclei.** Georgieva, A.I.; Raichev, P.P.; Rusev, R.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700795.

A boson representation of the Hamiltonian is introduced to describe the collective motion in nuclei. Two interacting vector bosons differing in their "pseudospin" projections are used. The six-dimensional unitary group U(6) is the group of dynamical symmetry of the Hamiltonian. The algebras of different subgroups of U(6) are investigated. The two-particle interaction of the Hamiltonian of the two vector-bosons is expressed in terms of the Casimir operators of the group in the reduction scheme. As a result of the proposed representation of the Hamiltonian it is possible to solve the eigenvalue problem explicitly.

41879 **(NASA-TP—1893) Optical-model abrasion cross sections for high-energy heavy ions.** Townsend, L.W. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Jul 1981. 18p. NTIS PC A02/MF A01.

Within the context of eikonal scattering theory, a generalized optical model potential approximation to the nucleus-nucleus multiple scattering series is used in an abrasion-ablation collision model to predict abrasion cross sections for relativistic projectile heavy ions. Unlike the optical limit of Glauber theory, which cannot be used for very light nuclei, the abrasion formalism is valid for any projectile target combination at any incident kinetic energy for which eikonal scattering theory can be utilized. Results are compared with experimental results and predictions from Glauber theory.

41880 **(ZfK—444) Coulomb potentials between spherical heavy ions.** Iwe, H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jun 1981. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82700797.

The Coulomb interaction between spherical nuclei having arbitrary radial nuclear charge distributions is calculated. All these realistic Coulomb potentials are given in terms of analytical expressions and are available for immediate application. So in no case a numerical computation of the Coulomb integral is required. The parameters of the charge distributions are taken from electron scattering analysis. The Coulomb self-energies of the charge distributions used are also calculated analytically in a closed form. For a number of nucleus-nucleus pairs, the Coulomb potentials derived from realistic charge distributions are compared with those normally used in various nucleus-nucleus optical model calculations. In this connection a detailed discussion of the problem how to choose consistently Coulomb parameters for different approximations is given.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 41313, 41430, 41874, 41885

41881 (DOE/EV/01105—281) Transport calculations for a 14.8 MeV neutron beam in a water phantom. Goetsch, S.J. (Wisconsin Univ., Madison (USA). Dept. of Medical Physics). 1981. Contract AS02-76EV01105. 22p. NTIS, PC A02/MF A01. Order Number DE82009364.

A coupled neutron/photon Monte Carlo radiation transport code (MORSE-CG) has been used to calculate neutron and photon doses in a water phantom irradiated by 14.8 MeV neutrons from the Gas Target Neutron Source. The source-collimator-phantom geometry was carefully simulated. Results of calculations utilizing two different statistical estimators (next-collision and track-length) are presented.

41882 (DOE/EV/01105—286) Anti W comparisons for A150 plastic-equivalent gases, TE gas, and air. Pearson, D.W.; DeLuca, P.M. Jr.; Schell, M.C.; Attix, F.H.; Awschalom, M.; Rosenberg, I.; Ten Haken, R.K. (Wisconsin Univ., Madison (USA). Dept. of Medical Physics; Fermi National Accelerator Lab., Batavia, IL (USA)). 1981. Contract AS02-76EV01105. 18p. NTIS, PC A02/MF A01. Order Number DE82009370.

As part of our continuing evaluation of A150 plastic equivalent gases for neutron dosimetry, we have measured ionization ratios which are related to anti W ratios between gases in the p(66)Be(49) neutron beam at Fermilab. Additionally we have extended our earlier measurements (DeLuca, et al., 1980) at the UW gas target $^{3}H(d,n)^{4}He$ neutron source to include an uncollimated beam geometry with ion chambers close to the target. Observed differences from the earlier results can probably be explained on the basis of neutron spectra, which await further determination.

41883 (EFI—429(36)-80) Total radiation and the boundary effect in the case of two absorbing plates with account for multiple scattering. Vardanyan, L.A.; Yan Shi. (Erevanskij Fizicheskij Inst. (USSR)). 1980. 45p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82700791.

The influence of multiple scattering on the transition radiation formation of the charged particle passing through a stack of two absorbing plates is investigated. The boundary effect is shown to consist of the sum of one plate boundary effect, multiplied by the effective number of plates, and the interference term. A detailed investigation of the interference term behaviour depending on both the vacuum spacing and the relations between the formation zones of transition radiation and bremsstrahlung is carried out. It is found out that the picture of the interference of radiation from both plates substantially depends on the size if the transition radiation zone in vacuum, while in the case where the bremsstrahlung mechanism of the radiation formation dominates, the bremsstrahlung formation zone is significant as well. The calculation plots of the frequency spectrum of the total radiation as well as of the boundary effect are presented.

6550 Medical Physics

REFER ALSO TO CITATION(S) 41618, 41881, 41882

41884 (DOE/EV/01105—279) Progress overview, July 1, 1980-September 30, 1981. Attix, F.H.; DeLuca, P.M. Jr. (Wisconsin Univ., Madison (USA). Dept. of Medical Physics). 1981. Contract AS02-76EV01105. 11p. NTIS, PC A02/MF A01. Order Number DE82009362.

Research during the period July 1980 through September 1981 at University of Wisconsin Department of Medical Physics is summarized. Topics covered include: development of an Al50 plastic equivalent gas for proportional counter applications; quantum efficiency comparisons for A150 plastic-equivalent gases; fast-neutron cavity theory; Monte Carlo transport code; use of the tandem source facility for sequential or simultaneous irradiation of mammalian cells with 14.8 MeV neutrons and cobalt 60 photons; a method for applying microdosimetry in estimating biological response; and application of graphite and Al50-plastic walled proportional counters and a TE ion chamber to the determination of neutron/photon doses. (GHT)

41885 (DOE/EV/01105—284) Application of A150-plastic equivalent gases in microdosimetric measurements. DeLuca, P.M. Jr.; Higgins, P.D.; Pearson, D.W.; Schell, M.; Attix, F.H. (Wisconsin Univ., Madison (USA). Dept. of Medical Physics). 1981. Contract AS02-76EV01105. 23p. NTIS, PC A02/MF A01. Order Number DE82009368.

Neutron dosimetry measurements with ionization chambers, for the most part, employ tissue equivalent plastic-walled cavities (Shonka A150) filled with either air or a methane-base tissue-like gas. The atomic composition of TE-gas and A150 plastic are not matched and are quite dissimilar from muscle. Awschalom and Attix (1980) have partially resolved the problem by formulating a novel A150-plastic equivalent gas. This establishes a homogeneous wall-gas cavity dosimeter for neutron measurements and confines the necessary corrections to the applications of kerma ratios. In this report, we present measurements of applications of two A150-plastic equivalent gases in a low pressure spherical proportional counter. Gas gains and alpha-particle resolutions were determined. For these A150-mixtures as well as a methane-based TE-gas and an Ar-CO_2 mixture, we report measurements of event size distributions from exposure to a beam of 14.8 MeV neutrons.

41886 (DOE/EV/01105—285) Fast-neutron and photon doses determined with proportional counters and ionization chambers. DeLuca, P.M. Jr.; Higgins, P.D.; Schell, M.C.; Pearson, D.W. (Wisconsin Univ., Madison (USA). Dept. of Medical Physics). 1981. Contract AS02-76EV01105. 15p. NTIS, PC A02/MF A01. Order Number DE82009369.

A ^{60}Co teletherapy source has recently been coupled to an existing source of fast neutrons. These sources may be operated to provide precise and controlled mixtures of photons and neutrons. In this work we report the application of paired miniature proportional counters to n/γ dose separation. Graphite- and A150 plastic-walled proportional counters were employed. Results are compared to dose values deduced from a cnventional A150 plastic ionization chamber and a neutron insensitive GM counter.

41887 (PB—82-100181) The NBS 14 MeV absolute neutron beam facility. Final report. Duvall, K.C.; Wasson, O.A. (National Bureau of Standards, Washington, DC (USA)). Apr 1981. 2p. Proceedings of Conference on Application of Accelerators in Research and Industry (1980), North Texas State Univ., Denton, TX., November 3-5, 1980, IEEE Transactions in Nuclear Science NS-28, n2 p1488-1489 Apr 81.

A 14 MeV absolute neutron beam has been established at the NBS 3 MV positive-ion Van de Graaff Accelerator Laboratory. The neutron flux is absolutely determined by the measurement of the associated alpha particle rate in a silicon surface barrier detector positioned at 84 degrees with respect to the beam axis. The facility may be used to measure the absolute response of active neutron monitoring devices with high accuracy. The neutron background contributions may be eliminated in the calibration measurements by using the coincidence between the device and the solid state alpha detector. This method allows a neutron flux in a cone of 2 degree half angle to be placed at 90 degrees with respect to the beam axis.

41888 Radiobiological input to radiation protection standards. Bond, V.P. (Brookhaven National Lab., Upton, NY (USA)). *Health Physics;* **41**: No. 6, 799-806(Dec 1981).

A brief review of the radiobiological data relevant to radiation protection standards is given. In particular the nature of the dose-response relationships for mutagenesis and carcinogenesis in animals and man is discussed with reference to the BEIR 1 1972, the NRC75, the UNSCEAR 77 and the NCRP80 Reports. It was concluded that the linear-no-threshold relationship for mutagenesis and carcinogenesis is too simple and that the relationship is best described by curves of varying slopes depending on the dose rate. By examining the data on the incidence of actual tumour systems in animals and man in relation to radiation dose, it was shown that the relationships developed in the simple Tradescantia single-cell system appear to hold widely throughout radiobiology. In developing radiation protection standards, first animal and human radiobiological data were used in determining an appropriate risk coeffi-

cient for late and genetic effects for the human being, and second an appropriate comparison of radiation and other more common risks was used as a basis for setting limits of incidence in the exposed population/individual.

41889 **(ORNL-tr—4815) Response of neutron dosimeters to different neutron fields.** Sgraja, D. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. Translation of SAAS—281. 29p. NTIS, PC A03/MF A01. Order Number DE82011837.

Correction factors have been calculated for the reading of two different fission-fragment dosimeters (with ^{237}Np and $^{232}Th/U$ radiators, respectively) in neutron fields of various unshielded and shielded sources. Shielding materials considered were water, polyethylene, concrete, and iron; thicknesses varied up to 180 cm. For three primary neutron spectra shielding factor-versus-thickness plots have been given as an aid to roughly assessing the exposure situation at neutron working places.

41890 **Radioactivity standardization of /sup 99m/ Tc and /sup 99/ Mo.** Ayres, R.L.; Hirshfeld, A.T. (NBS). *Transactions of the American Nuclear Society;* **38**: 56-57(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41891 **The MIRD technique for internal radiation dose estimation.** Cloutier, R.J.; Watson, E.E. (ORAU). *Transactions of the American Nuclear Society;* **38**: 58-59(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41892 **Mathematical phantoms for evaluation of age-specific internal dose.** Cristy, M. (ORNL). *Transactions of the American Nuclear Society;* **38**: 60-61(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41893 **The point source repository assumption and predicted individual doses.** Edwards, L.L.; Harvey, T.F. (LLNL, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **38**: 159-160(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

6560 Solid State Physics

REFER ALSO TO CITATION(S) 41105

41894 **(DOE/ER/10459—28) Inter-subband optical absorption in an inversion layer on a semiconductor surface in tilted magnetic fields.** O'Connell, R.F. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). 1982. Contract AS05-79ER10459. 14p. NTIS, PC A02/MF A01. Order Number DE82011591.

Considerable progress has been made in our studies of Faraday rotation and other magneto-optical phenomena in MOS (metal-oxide-semiconductor) systems. These studies have also led to three interesting spin-off investigations: (a) multiple-reflection effects (we pointed out a discrepancy between two existing models and we generalized the correct model as a basis for enabling us to consider such effects in MOS systems), (b) magneto-transmission in an electron inversion layer of finite thickness (which enables us to obtain a recipe for the calculation of the surface conductivity), and (c) absorption of radiation propagating obliquely in a magnetoplasma. Progress is briefly reviewed. (WHK)

41895 **(DOE/ER/10913—1) Multicomponent diffusion under general chemical-potential gradients. Progress report, July 1, 1981-January 31, 1982.** Sato, H.; Kikuchi, R. (Purdue Univ., Lafayette, IN (USA)). 1982. Contract AC02-81ER10913. 13p. NTIS, PC A02/MF A01. Order Number DE82008815.

The derivation of the Onsager equation for diffusion under general chemical potential gradients for three component systems has been re-examined and corrected suitably for application. The corrections include: (1) extension of the ensemble averaging method in deriving material transport of the original Path Probability Method (PPM) to include the time averaging; (2) generalization of the concept of the correlation factor for isotope diffusion to experiments in multicomponent systems. The formulation for chemical diffusion in a multicomponent system under general chemical potential gradients has thus been made based on the above background. Material transport under a temperature gradient (thermal diffusion) has then been formulated by the PPM for the first time. The formulation for the chemical potential maps of three components systems by the pair approximation of the Cluster Variation Method was made as a basis for the study of the diffusion path and zero-flux planes.

41896 **Calculation of the properties of metallic hydrogen using Monte Carlo.** Ceperley, D.M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Alder, B.J. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Physica B+C (Amsterdam);* **108**: No. 1-3, 875-876(Aug-Sep 1981).

From 16. international conference on low temperature physics; Los Angeles, CA, USA (19 - 25 Aug 1981).

The application of Monte Carlo to hydrogen at zero temperature is discussed. The trial function is a generalization of the pair product type used for hellium. Preliminary results for the metallic phase are given.

6561 Superconductivity

REFER ALSO TO CITATION(S) 41124, 41152

41897 **(AD-A—102807/5) Nonequilibrium superconducting states with two coexisting energy gaps. Interim report.** Schoen, G.; Tremblay, A. (Cornell Univ., Ithaca, NY (USA). Lab. of Atomic and Solid State Physics). Nov 1978. 12p. NTIS, PC A02/MF A01.

The effect of tunnel currents in superconducting junctions on the energy gap is calculated. For certain parameters two different gaps can exist. The stability of these solutions is investigated and at a certain voltage a first order transition is found. This result explains the experimentally observed inhomogeneous states in superconducting tunnel junctions.

41898 **(AD-A—102808/3) Effect of nonequilibrium phonons on superconducting states with two coexisting energy gaps. Interim report.** Tremblay, A.; Schoen, G. (Cornell Univ., Ithaca, NY (USA). Lab. of Atomic and Solid State Physics). Oct 1979. 7p. NTIS, PC A02/MF A01.

It is shown that under the influence of tunnel currents, superconductors may exhibit a first order transition to a state with two coexisting energy gaps. An energy and number conserving approximation for the collision operator is used to explicitly take into account in the theory the effect of nonequilibrium phonons. Quantitative predictions for experiments are presented.

41899 **(PB—81-236523) Effect of thermal contraction of sample-holder material on critical current. Final report.** Fujii, G.; Ekin, J.W.; Radebaugh, R.; Clark, A.F. (National Bureau of Standards, Washington, DC (USA)). 1980. 9p. Proceedings of the International Cryogenic Materials Conference held at Madison, WI, on August 24-29, 1979, Paper I-1 in Advances in Cryogenic Engineering Materials 26, p589-598 1980.

As part of a program to develop standard practices for measuring critical current (I sub c), the I sub c characteristics of commercial multifilamentary Nb_3Sn and V_3Ga wires have been measured using phenolic, copper, and fiberglass epoxy (NEMA G-10) sample holders. For each of these materials, I sub c was measured with the sample in a hair-pin geometry supported in two different ways to prevent movement from Lorentz forces: first with the

sample freely suspended in a slot machined in the support material, and second, with the sample frozen in place with vacuum grease.

41900 **(PB—81-236580) Cryogenics for SQUIDS. Final report.** Zimmerman, J.E. (National Bureau of Standards, Washington, DC (USA)). 1980. 21p. Proceedings of International Conference Superconducting Quantum Devices (2nd), Berlin, Germany, F.R., May 6-9, 1980, Paper in Squid '80, p423-443 1980.

While not much work on SQUID cryocoolers as such has been done yet, a large amount of work on higher temperature refrigerators for infrared sensors and for use in spacecraft provides a sophisticated technical base upon which to build. A low-power five-stage Stirling cryocooler with a single-component SQUID gradiometer has begun operation. Although this machine requires only 20 W of mechanical power input to maintain a temperature of 7 K, a large reduction of input power is theoretically possible.

41901 **Thermal propagation of normal-superconductor boundaries.** Gray, K.E.; Zasadzinski, J.; Kampwirth, R.T. (Argonne National Lab., IL (USA)). *Physica B+C (Amsterdam);* **108**: No. 1-3, 1031-1032(Aug-Sep 1981).

From 16. international conference on low temperature physics; Los Angeles, CA, USA (19 - 25 Aug 1981).

The model of Newhouse for thermal propagation of long normal regions in thin superconducting films on good thermal conducting substrates has been verified. Measurements show much slower velocities for short regions, but the dependence is compatible with a new model calculation. Stable hot spots are found which agree semi-quantitatively with a modified hot spot calculation.

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 41894

41902 **(EUR—7357-EN) Behaviour of systems subject to random fluctuations.** Jones, A.V. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 78p. Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg.

The first part of this report considers random fluctuations in a general linearizable systems under the assumptions of Markovianity and stationarity, and introduces the Smoluchovski equation, the master equation and the Fokker-Planck equation. An alternative formulation in terms of radom flights and fluctuating driving forces (the Langevin approach) is then presented, and the Nyquist theorem and its generalization, the fluctuation-dissipation theorem, are derived. Mention is also made of the approach to fluctuations via irreversible thermodynamics. As a specific example discrete fluctuations where viable may change in steps of + 1 only is discussed. In the second part of the report an explanation is given of the suitability of semiconducting materials for experimental verification of models of fluctuating systems based on the theory presented in the first part, and the predicted behaviour in systems with two, three and four possible states and given transition probabilities between the states is compared with experimental evidence.

6580 Mathematical Physics

41903 **(RL—81-002) Diagonal term in boundary integral method.** Fan, M.W. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Dec 1980. 10p. Rutherford and Appleton Laboratories, Chilton, Didcot, Oxon, OX11 OQX England.

Portions of document are illegible.

Boundary integral methods require the solution of an integral equation with a weakly singular kernel. Numerical solutions can be obtained by finite-element discretization and point matching or collocation. the coupling coefficients must then be obtained at points where the kernel is singular. Analytic expression for the integrals at such points often involve the solid angles subtended at the point by the surface. This paper describes the evaluation of the solid angle for rotationally symmetric geometries.

70 FUSION ENERGY

REFER ALSO TO CITATION(S) 40724

41904 **Technology index for plasmaphysics research and fusion reactors. Bibliography, author index, subject index, appendix.** *Technik-Index ueber Plasmaphysikalische Forschung und Fusionsreaktoren;* **14**: No. 12, vp(1980).

7001 Plasma Research

REFER ALSO TO CITATION(S) 41941

41905 **(AD-A—097772/8) Fast ion stopping power in dense, ionized plasmas. Memorandum report.** Rogerson, J.E. (Naval Research Lab., Washington, DC (USA)). 17 Apr 1981. 41p. (NRL-MR—4485). NTIS PC A03/MF A01.

A model is presented for calculating stopping cross sections for ions in ionized plasma targets. This approach utilizes a local oscillator model to calculate stopping power by bound electrons. Results obtained from this formulation are presented and compared with other calculations.

41906 **(AD-A—097941/9) Propagation of low-gamma ion beams -- the resistive hose instability.** Feinstein, R.L. (Science Applications, Inc., Palo Alto, CA (USA)). 30 Dec 1980. 62p. (SAI—1-227-00-413-00). NTIS PC A04/MF A01.

In this report on the propagation of low-gamma ion beams, we explore the resistive hose instability with longitudinal velocity-spread. For energies of interest, the theoretical models of electron beam propagation, cannot be directly applied to ions because of their low relativistic gamma (gamma) factors. For example, for kinetic energy equal to 50 MeV, gamma is = to or about 99. for electrons compared to gamma is = to or about 1.05 for protons. If the beam propagates in the longitudinal direction (along the z-axis), the effective inertial mass of the beam particles in the z-direction is given approximately by gamma 3 cubed m, where m is the particle rest mass. This suggests that light ions are considerably more susceptible to longitudinal acceleration than electrons of equivalent kinetic energy; the longitudinal particle-motion cannot be ignored as in the electron case. This adds a new dimension to ion beam propagation. The consequences of the longitudinal motion on beam stability can divided into three categories: (1) Longitudinal spreading of the beam pulse due to longitudinal velocity-spread (longitudinal temperature); (2) Longitudinal mass (bunching) instability; and (3) Resistive hose instability with longitudinal velocity spread.

41907 **(AD-A—098045/8) Calculations of Brillouin backscatter in laser-produced plasmas. Memorandum report.** Manheimer, W.M.; Colombant, D.G. (Naval Research Lab., Washington, DC (USA)). 24 Apr 1981. 34p. (NRL-MR—4503). NTIS PC A03/MF A01.

Brillouin backscatter is calculated in an inhomogeneous laser produced plasma. Equations for the spatial dependence of the incident reflected and sound wave are numerically integrated through the underdense plasma. Effects investigated are the stabilizing effects of ion heating or nonlinear sound wave dissipation, flow velocity magnitude and gradient, electron heating and broad band incident laser light. We find that the effect of velocity gradient and broad band light can be very important in reducing the backscatter.

41908 **(AD-A—098123/3) A fully two-dimensional equilibrium and transport model of the poloidal divertor. Memorandum report.** Emery, M.H.; Winsor, N.K. (Naval Research Lab., Washington, DC (USA)). 20 Apr 1981. 86p. (NRL-MR—4498). NTIS PC A05/MF A01.

We have developed a fully two-dimensional Eulerian-Lagrangian nonideal MHD simulation model of tokamak discharges. The code is designed to simultaneously follow the resistive diffusion transport and gross dynamics of a magnetically confined plasma of arbitrary shape. It uses as a finite-difference mesh a general connectivity triangular grid. the triangular grid is the natural choice for a finite-difference mesh for modeling complicated geom-

etries with interfaces, multiple magnetic axes and separatrices. We present here the methods we have developed to calculate equilibria and transport in a fully two-dimensional geometry. The model is sufficiently general that is capable of calculating equilibria and transport given rather general plasma geometries and coil structures. Here we apply the model to the poloidal divertor system and describe the results.

41909 **(IPPCZ—239) Progress report, 1979-1980.** (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). Jan 1981. 98p. Pod Vodarenskou VEZI 4, 18069 Prague 8, Czechoslovakia.

Portions of document are illegible.

The scientific programme of the Institute consists of the following: (a) high frequency heating of the plasma in toroidal devices, (b) interaction of intense relativistic electron beams with plasmas, (c) applied plasma physics - the volume and surface interaction of the plasma, and (d) electron circular accelerators - betatrons. Research on each is described.

41910 **(JAERI-M—9278) MHD equilibrium code EQUCIR version 2 applicable to up-down asymmetric toroidal plasma.** Shinya, K.; Ninomiya, H. (Japan Atomic Energy Research Inst., Tokyo). Jan 1981. 18p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82700743.

Computer code EQUCIR version 2, which can analyse tokamak plasma equilibrium without assuming up-down symmetry with respect to the mid-plane, has been developed. This code is essentially the same as EQUCIR version 1 which has already been reported and can deal with only symmetrical plasma with respect to the mid-plane. Because data input stream is slightly different from version 1 physical background of the change and the method of calculation are explained. Data input manual for the different points is also summarized. The code has been applied to the analysis of INTOR single-null divertor plasmas and to the design of hybrid poloidal coils resulting in useful and powerful means for the design.

41911 **(LA—9040) Model calculations for the explosive generator-driven dense plasma focus.** Brownell, J.; Landshoff, R. (Los Alamos National Lab., NM (USA)). Feb 1982. Contract W-7405-ENG-36. 11p. NTIS, PC A02/MF A01. Order Number DE82008960.

A models was developed to aid in the design and interpretation of explosive generator-driven dense plasma focus experiments. Several models were investigated, but the one presented here employs a plane sheath propagating along the barrel of a Mather-type gun, entraining a constant fraction of the swept-up gas and carrying the return current between the electrodes. The motion of the sheath is determined from the momentum equation using the integrated magnetic force on the sheath. The solutions are obtained both numerically and by an approximate analytic procedure, and the performance of the system has been determined as a funtion of the switching time when the generator is connected to the dense plasma focus.

41912 **(LBL—13621) Noncanonical Hamiltonian methods in plasma dynamics.** Kaufman, A.N. (Lawrence Livermore National Lab., CA (USA)). Nov 1981. Contract W-7405-ENG-48. 6p. (CONF-811185—1). NTIS, PC A02/MF A01. Order Number DE82008429.

From Japan/US workshop on nonequilibrium statistical physics; Kyoto, Japan (9 Nov 1981).

A Hamiltonian approach to plasma dynamics has numerous advantages over equivalent formulations which ignore the underlying Hamiltonian structure. In addition to achieving a deeper understanding of processes, Hamiltonian methods yield concise expressions (such as the Kubo form for linear susceptibility), greatly shorten the length of calculations, expose relationships (such as between the ponderomotive Hamiltonian and the linear susceptibility), determine invariants in terms of symmetry operations, and cover situations of great generality. In addition, they yield the Poincare invariants, in particular Liouville volume and adiabatic actions.

41913 **(PLF—41) High-speed photography of laser-irradiated thin foils.** Teng, Y.; Fedosejevs, R.; Sigel, R.; Eidmann, K.; Petsch, R.; Spindler, G. (Max-Planck-Gesellschaft zur Foerderung der Wissenschaften e.V., Garching (Germany, F.R.). Projektgruppe fuer Laserforschung). Oct 1980. 14p. (CONF-8009132—8). Max-Planck-Gesellschaft, D-8046 Garching bei, Munichen, Germany.

From 14. European conference on laser interaction with matter; Palaiseau, France (15 Sep 1980).

Thin plastic foils (2 to 10 μm thickness) were irradiated with the iodine laser ASTERIX III ($\lambda = 1.3$ μm). Pulse energy was 100 J, pulse duration 300 ps; the intensity on target was varied in the range 10^{14} - 5 x 10^{15} W/cm^{-2}. An active-passively modelocked, flashlamp-pumped dye laser was synchronized with the iodine laser pulse. A single dye laser pulse ($\sim$ 10 ps duration) was used to study the gasdynamic motion of the foil material during and after irradiation by shadowgraphy. Besides the expected acceleration of the foil under one-sided irradiation we also find strong disturbances of the foil at distances far from the irradiated area, especially at high irradiances. The results will be discussed and compared with previous, calorimetric measurements of thin foil acceleration.

41914 **'Ballistic damping' - a possible technique for stabilizing resonant ion cyclotron modes in mirror systems.** Post, R.F. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Fusion;* **22**: No. 1, 63-75(Jan 1982).

A technique called "ballistic damping" is proposed for the control of ion cyclotron instabilities of the highly coherent type characteristically observed in mirror-confined plasmas at high plasma density. Ion beams, launched parallel to the field lines, transit the plasma resonantly gaining perpendicular energy from the unstable wave. These ions exit through the far mirror, thereby extracting energy from the wave. Critical beam currents required to achieve marginal stability, as estimated from power balance considerations, lie well within existing beam technology, both for present mirror or tandem mirror experiments and for scaled-up systems.

41915 **Linear stability analysis of MHD models in axisymmetric toroidal geometry.** Manickam, J.; Grimm, R.C.; Dewar, R.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Computer Physics Communications;* **24**: No. 3/4, 355-361(Dec 1981).

From European workshop on MHD modeling of magnetically confined plasmas; Wildhaus, Switzerland (9 - 11 Sep 1981).

A computational model to analyze the linear stability properties of general toroidal systems in the ideal magnetohydrodynamic limits is presented. This model includes an explicit treatment of the asymptotic singular behaviour at rational surfaces. It is verified through applications to internal kink modes.

41916 **Solution of the time-dependent, three-dimensional resistive magnetohydrodynamic equations.** Finan, C.H. III; Killeen, J. (California Univ., Livermore (USA). National MFE-Computer Center; California Univ., Davis (USA). Dept. of Applied Science). *Computer Physics Communications;* **24**: No. 3/4, 441-463(Dec 1981).

From European workshop on MHD modeling of magnetically confined plasmas; Wildhaus, Switzerland (9 - 11 Sep 1981).

Resistive magnetohydrodynamics (MHD) is described by a set of eight coupled, nonlinear, three-dimensional, time-dependent, partial differential equations. A computer code, IMP (Implicit MHD Program), has been developed to solve these equations numerically by the method of finite differences on an Eulerian mesh. In this model, the equations are expressed in orthogonal curvilinear coordinates, making the code applicable to a variety of coordinate systems. The Douglas-Gunn algorithm for Alternating-Direction Implicit (ADI) temporal advancement is used to avoid the limitations in timestep size imposed by explicit methods. The equations are expressed as conservation laws; the momentum and energy equations are nonconservative. This is to: (1) provide enhanced numerical stability by eliminating errors introduced by the nonvanishing of nabla x B on the finite difference mesh; and, (2) allow the simulation of low β plasmas. The resulting finite difference equations are a coupled system of nonlinear algebraic equations which are solved by the Newton-Raphson iteration technique. We apply

our model to a number of problems of importance in magnetic fusion research. Ideal and resistive internal kink instabilities are simulated in a Cartesian geometry. Growth rates and nonlinear saturation amplitudes are found to be in agreement with previous analytic and numerical predictions. We also simulate these instabilities in a torus, which demonstrates the versatility of the orthogonal curvilinear coordinate representation.

41917 **Resistive MHD studies of high β tokamak plasmas.** Lynch, V.E.; Carreras, B.A.; Hicks, H.R.; Holmes, J.A.; Garcia, L. (Oak Ridge National Lab., TN (USA)). *Computer Physics Communications;* **24**: No. 3/4, 465-476(Dec 1981).

From European workshop on MHD modeling of magnetically confined plasmas; Wildhaus, Switzerland (9 - 11 Sep 1981).

Numerical calculations have been performed to study the MHD activity in high-β tokamaks such as ISX-B. These initial value calculations build on earlier low β techniques, but the β effects create several new numerical issues. These issues are discussed and resolved. In addition to time-stepping modules, our system of computer codes includes equilibrium solvers (used to provide an initial condition) and output modules, such as a magnetic field line follower and an X-ray diagnostic code. The transition from current driven modes at low β to predominantly pressure driven modes at high β is described. The nonlinear studies yield X-ray emissivity plots which are compared with experiment.

41918 **Novel techniques for plasma diagnostics: electron paramagnetic resonance and laser-induced fluorescence spectroscopy.** Miller, T.A. (Bell Laboratories, Murray Hill, NJ 07974). *Plasma Chemistry and Plasma Processing;* **1**: No. 1, 3-18(Mar 1981).

Diagnostic techniques for low-pressure, "cold" plasmas have mostly been limited to emmission and mass spectrometry. Herein, the techniques of gas-phase electron paramagnetic resonance and laser-induced fluorescence spectroscopy are briefly reviewed. Particular attention is paid to their attributes which make them good candidates for plasma diagnostic tools. It is found that gas-phase electron para- magnetic resonance can be used to determine and monitor the absolute concentra- tion of a number of important plasma species, e.g., free radicals and atoms Laser-induced fluorescence can also monitor, with even more sensitivity, but perhaps not so well absoluteiy, the concentrations of many plasma species, e.g., free radicals, measurable excited states, and molecular ions.

41919 **Plasma ion heating and energy loss from alpha-particle micro instabilities.** Choi, C.K.; Miley, G.H.; Sutton, W.R. (Univ of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **38**: 211-212(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41920 **Nuclear elastic scattering effects on fusion product transport in the FRM.** DeVeaux, J.C.; Greenspan, E.; Miley, G.H. (Univ of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **38**: 215-216(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41921 **Radiation from high-temperature tokamak plasmas.** Isler, R.C. (Oak Ridge National Lab., TN). pp 39-45 of Ultraviolet and vacuum ultraviolet systems. SPIE Volume 279. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1981). Contract W-7405-ENG-26.

The basic concept of plasma confinement in tokamaks is discussed and illustrations of the typical temperatures and densities that can be obtained are presented. The roles of impurities both as sources of power losses and as plasma diagnostics are emphasized. Particular attention is paid to the analysis of spectral data to obtain impurity concentrations, the deleterious effects of heavy metals, forbidden transitions, and spectral excitation by charge exchange reactions.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 40726, 40730, 40738, 40739, 40740, 40823, 41103, 41142, 41270, 41920

41922 **Method and device for producing nuclear fusion.** Roberts, T.G. US Patent Application 202,811. [nd]. Filed date 31 Oct 1980. 18p.

A triggering device and method for producing nuclear fusion reactions and having two or more intense pulses of high energy electrons derived from a single source and delivered to a target along separate paths but arriving at substantially the same time. The electron beams are produced in the electrode space of an electron accelerator which utilizes a cathode for producing multiple electron beams. Each electron beam is injected into a separate conventional linear pinch discharge. The high energy electron beams follow the pinch discharge and are delivered to the target. The pinch discharge tubes are curved so that each electron beam approaches the target from a different direction for irradiating the target symmetrically. Return conductors strategically located on the outer surface of each pinch discharge tube maintains the curved discharge within the center of the tube and sustains the pinch.

41923 **(AD-A—097991/4) Simulation of laser beam nonuniformity effects. Memorandum report.** Emery, M.H.; Orens, J.H.; Gardner, J.H.; Boris, J.P. (Naval Research Lab., Washington, DC (USA)). 24 Apr 1981. 23p. (NRL-MR—4500). NTIS PC A02/MF A01.

We investigate the effect of a nonuniform beam on the ablative acceleration of thin foils using the FAST2D laser-shell simulation code. The results show that laser nonuniformities with scalelengths greater than the distance from the ablation surface to the critical surface would have a severe impact on drive pressure symmetry and hence on pellet gain.

41924 **(AD-A—098084/7) An investigation of plasma - surface interactions on selected conductors and insulators. Master's thesis.** Barker, J.H. III; Rush, R.J. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1980. 108p. NTIS PC A06/MF A01.

Damage caused by plasma-surface interactions is of concern in fields involving the use of such plasma devices as particle beam weapons, high power lasers and controlled thermonuclear fusion reactors. Several conductors and non-conductors were exposed to a plasma to study the plasma-surface interaction damage. In one part of the study, the plasma was induced by irradiating the surface of the samples with a Q-switched neodymium laser. Some of the samples were irradiated in air, at atmospheric pressure, and in a vacuum, to compare the difference in the extent of the damage on the same types of samples at different pressures. In the other part of the study, several titanium coated conductors and titanium coated non-conductors were exposed to the plasma of a tokamak. Both the metal conductors in the first part of the study, and the titanium coatings in the second part of the study, were damaged by unipolar arcing. Nickel showed less evidence of unipolar arching damage than any of the other samples studied.

41925 **(BNL—51507) BNL Neutral-Beam Development Group. Progress report FY 1981.** Prelec, K.; Sluyters, T. (Brookhaven National Lab., Upton, NY (USA)). 15 Jan 1982. Contract AC02-76CH00016. 16p. NTIS, PC A02/MF A01. Order Number DE82008852.

The Brookhaven High Energy Neutral Beam Development Group is developing injector systems, particularly for the next generation of fusion mirror and tokamak experiments. These injectors are based on the acceleration and neutralization of negative deuterium ions, to utilize their high neutralization efficiency which is nearly independent of energy above 50 keV/nucleon.

41926 **(DOE/ER/53091—T2) Electron capture and loss cross sections and angular scattering of $D^{+,0,-}$ in Cs: formation of D^- beams for MFE experiments and reactors. Progress report No. 7, July 1 to September 30, 1981.** Coggiola, M.J.; Peterson, J.R. (SRI International, Menlo Park, CA (USA)). 15 Oct 1981. Contract AT03-80ER53091. 3p. NTIS, PC A02/MF A01. Order Number DE82008435.

The goal of this research is to provide a basis for determining the optimum conditions (target species and thickness) for producing D^- beams by the double capture technique. High production efficiency and low angular divergence are desired. The effort has two components: a modeling effort to determine the D^- yield and angular scattering as a function of target thickness, and an experimental effort to measure the angular differential cross sections that are required as input data in the model. Initial work in both areas has focussed on the H, D-Cs system, which has appeared to produce the highest D^- yields.

41927 **(DOE/ER/53091—T3) Collisional mechanisms in D^- beam sources for MFE experiments and reactors. Technical progress report.** Peterson, J.R.; Coggiola, M.J. (SRI International, Menlo Park, CA (USA)). 5 Feb 1982. Contract AT03-80ER53091. 19p. NTIS, PC A02/MF A01. Order Number DE82008333.

The goal of this research is to provide a basis for determining the optimum conditions (target species and thickness) for producing D^- beams by the double capture technique. High production efficiency and low angular divergence are desired. The effort has two components: a modeling effort to determine the D^- yield and angular scattering as a function of target thickness, and an experimental effort to measure the angular differential cross sections that are required as input data in the model. Initial work in both areas has focussed on the H, D^- Cs system, which has appeared to produce the highest D^- yields. The nature of the program is described in Appendix A. A brief description is given of accomplishments to date.

41928 **(DOE/ET/51013—12) Soviet gyrotron research, 1969-1979.** Temkin, R.J. (Massachusetts Inst. of Tech., Cambridge (USA)). Mar 1981. Contract AC02-78ET51013. 21p. (PFC/RR—81-13). NTIS, PC A02/MF A01. Order Number DE82011864.

This report is a listing of 134 articles on gyrotrons published in Soviet journals in the years 1967-1979. The bibliography should prove useful to those engaged in gyrotron research.

41929 **(DOE/TIC—11600(Vol.1)) Fusion Engineering Device. Volume 1. Mission and program summary.** (General Atomic Co., San Diego, CA (USA)). Oct 1981. 134p. NTIS, PC A07/MF A01. Order Number DE82008931.

This volume presents, in summary form, a recommended approach to implementing the Magnetic Fusion Energy Engineering Act of 1980. These recommendations constitute the findings of the FED Technical Management Board (TMB). The TMB and the affiliated technical managers gave particular scrutiny to elucidating the role of FED in fusion development and to defining the device mission.

41930 **(DOE/TIC—11600(Vol.3)) Fusion Engineering Device. Volume III. Test plan.** (General Atomic Co., San Diego, CA (USA)). Oct 1981. 103p. NTIS, PC A06/MF A01. Order Number DE82008933.

The description of the test plan begins with a statement of the key objectives and the presentation of a timetable for meeting those objectives. In so doing, it is convenient to regard the operating history of the devices as consisting of a number of distinct stages for resolving the outstanding physics and engineering questions. These states are identified and related to the overall test plan. succeeding chapters relate the test plan to other elements of the design process. Chapter 2 describes how the basic ingredients of the device mission are to be fulfilled. Chapter 2 ddescribes how the basic ingredients of the device mission are to be fulfilled. This narrative revolves around the three themes that are central to the mission statement: the demonstration o integrated machine operation, the production of sustained fusion energy, and the extraction of fusion power. Chapter 3 describes the impact of the testing program on FED design and operation, with the primary focus being upon nuclear system testing.

41931 **(DOE/TIC—11600(Vol.4)) Fusion Engineering Device. Volume IV. Physics basis and physics R and D requirements.** (General Atomic Co., San Diego, CA (USA)). Oct 1981. 195p. NTIS, PC A07/MF A01. Order Number DE82008934.

This volume covers the following issues: (1) confinement scaling, (2) cross section shaping, limits on B and q, (3) ion cyclotron heating, (4) neutral beam heating, (5) mechanical pump limiter, (6) poloidal divertor, and (7) non-divertor active impurity control.

41932 **(DOE/TIC—11600(Vol.5)) Fusion Engineering Device. Volume V. Technology R and D requirements for construction.** (General Atomic Co., San Diego, CA (USA)). Oct 1981. 108p. NTIS, PC A06/MF A01. Order Number DE82008936.

This volume covers the following areas: (1) nuclear systems, (2) auxiliary heating, (3) magnet systems, (4) remote maintenance, (5) fueling, (6) diagnostics, instrumentation, information and control, and (7) safety and environment. (MOW)

41933 **(HEDL-SA—2514) Fundamental radiation effects studies in the fusion-materials program.** Doran, D.G. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1981. Contract AC06-76FF02170. 43p. (CONF-811145—8). NTIS, PC A03/MF A01. Order Number DE82008436.

From International conference on neutron irradiation effects; Argonne, IL, USA (9 Nov 1981).

Some examples of progress being made in DAFS studies are given. The primary parameters in which most damage models are expressed are total displacements per atom (dpa), total helium concentration (appm), and the helium-to-dpa ratio. The concentrations of other transmutation products than helium have assumed significance in certain cases as will be seen below. The number of dpa is generally taken proportional to the damage energy, the total energy deposited in a material, corrected for the fraction dissipated in electronic excitation and ionization.

41934 **(HEDL-SA—2599) Fusion materials irradiation test facility: description and status.** Trego, A.L.; Parker, E.F.; Hagan, J.W. (Hanford Engineering Development Lab., Richland, WA (USA)). Jan 1982. Contract AC06-76FF02170. 17p. NTIS, PC A02/MF A01. Order Number DE82008433.

The Fusion Materials Irradiation Test (FMIT) Facility will generate a high-flux, high-energy neutron source that will provide a fusion-like radiation environment for fusion reactor materials development. The neutrons will be produced in a nuclear stripping reaction by impinging a 35 MeV beam of deuterons from an Alvarez-type linear accelerator on a flowing lithium target. The target will be located in a test cell which will provide an irradiation volume of over 750l within which 10 cm^3 will have an average neutron flux of greater than 1.4×10^{15} n/cm^2-s and 500 cm^3 an average flux of greater than 2.2 by 10^{14} n/cm^2-s with an expected availability factor greater than 65%. The projected fluence within the 10 cm^3 high flux region of FMIT will effect damage upon the materials test specimens to 30 dpa (displacements per atom) for each 90 day irradiation period. This irradiation flux volume will be at least 500 times larger than that of any other facility with comparable neutron energy and will fully meet the fusion materials damage research objective of 100 dpa within three years for the first round of tests.

41935 **(JAERI-M—9226) Computer simulation code of heat input due to incidence of fast ion beam.** Ito, T.; Horiike, H.; Matsuoka, M.; Matsuda, S.; Ohara, Y. (Japan Atomic Energy Research Inst., Tokyo). Dec 1980. 49p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82700739.

A computer code has been developed to evaluate heat flux due to bombardment of ion beam to the beam limiters and beam dump of the neutral beam injector. In this code, energetic ions extracted from the ion source are represented by finite number of test

particles, and their trajectories are calculated in the presense of magnetic field. They are bent and reflected as they pass through the bending magnet region. Finally they bombard the wall of the beam limiters and beam dump, where their energies are deposited. The heat flux can be derived from the number of bombarding test particles in a unit area. The code has been applied to the design of beam line hardwares of the JT-60 neutral beam injectors.

41936 **(ORNL/TM—8008) Example of a distributed-intelligence data-acquisition system using the CAMAC approach.** Francis, J.E. Jr.; Stewart, C.R.; Overbey, D.R. (Oak Ridge National Lab., TN (USA)). Mar 1982. Contract W-7405-ENG-26. 35p. NTIS, PC A03/MF A01. Order Number DE82008906.

The Fusion Energy Division has many diagnostics connected to the same experiment, and correlating the data acquired is very important. The system described in this paper is modular in concept, provides intelligence to the various modules, and yields high throughput by the use of parallel processing and high-speed interfaces. Two examples of how this system was implemented are given.

41937 **(ORNL/TM—8122) Magnetic-field-distribution effects on direct recovery efficiency.** Whealton, J.H.; Wooten, J.W. (Oak Ridge National Lab., TN (USA)). Apr 1982. Contract W-7405-ENG-26. 62p. NTIS, PC A04/MF A01. Order Number DE82009601.

The ion recovery efficiency of a transverse magnetic field monochromatic direct recovery device intended for intense neutral beams is examined theoretically by solving a Poisson-Vlasov equation for an upper and lower bound representation of the neutralizer plasma. The variation of recovery efficiency with magnetic field distribution, excess ion velocity, beam perveance, and target plasma properties is considered.

41938 **(PNL-SA—7700) Economic implications of fusion-fission energy systems.** Deonigi, D.E.; Schulte, S.C. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1979. Contract AC06-76RL01830. 11p. (CONF-790117—4). NTIS, PC A02/MF A01. Order Number DE82008592.

From 3. US/USSR symposium on fusion - fission hybrids; Princeton, NJ, USA (22 Jan 1979).

The principal conclusions that can be made based on the estimated costs reported in this paper are twofold. First, hybrid reactors operating symbiotically with conventional fission reactors are a potentially attractive supply alternative. Estimated hybrid energy system costs are slightly greater than estimated costs of the most attractive alternatives. However, given the technological, economic, and institutional uncertainties associated with future energy supply, differences of such magnitude are of little significance. Second, to be economically viable, hybrid reactors must be both fuel producers and electricity producers. A data point representing each hybrid reactor driver-blanket concept is plotted as a function of net electrical production efficiency and annual fuel production. The plots illustrate that the most economically viable reactor concepts are those that produce both fuel and electricity.

41939 **(UCID—19334) Pressure limits of negative ion sources based upon gas efficiency and extracted ion-current density.** Fink, J. (Lawrence Livermore National Lab., CA (USA)). 10 Mar 1982. Contract W-7405-ENG-48. 16p. NTIS, PC A02/MF A01. Order Number DE82009302.

The nature of the electrical discharge has an obvious impact upon the gas efficiency of an ion source and on the current density whch can be drawn from it. However external factors, such as the conductance of the grids and the background pressure along the beamline, also have an effect. Simple approximations based upon these factors show that there is a lower limit to the pressure of an ion source, which can deliver an ion beam of given current density at a specific gas efficiency. Estimates of ion stripping losses in a double gridded structure show that for all practical purposes, there is an upper limit as well.

41940 **(SAND—82-6006) Approximation theory of compression and similarity relationships for thin-shell targets.** Afanas'ev, Yu.V.; Gamalii, E.G.; Gus'kov, S.Yu.; Rozanov, V.B. (Sandia National Labs., Albuquerque, NM (USA)). 7 Feb 1982. Contract AC04-76DP00789. Translation of Preprint No. 30, P.N. Lebedev Physics Institute, Moscow, USSR, 1980. 44p. NTIS, PC A03/MF A01. Order Number DE82011835.

The problem of ablation and compression of a thin shell is solved analytically in the approximation that stationary flow in the corona infinitely rapidly is added onto the motion of the shell. From the solution it follows that the dynamic characteristics of the shell - the transfer coefficient for transformation of laser energy to kinetic energy, the relative unablated mass, and the compression rate - are the same for targets which are characterized by the same value of the parameter $\alpha = (R_0/\Delta R_0)/(\rho_0/\rho_{*0})$ (ΔR_0, R_0, ρ_0 are the initial thickness, radius and density of the shell, ρ_* is the characteristic density at the sonic point of the corona). Using these solutions, we may construct similarity relationships both for the compression and for the hydrodynamic instability at the outer boundary of the shell, and we may determine the maximum allowable value of the aspect ratio.

41941 **Micro-processor controlled data acquisition instrument for neutron activation measurements.** Jones, B.A. (Lawrence Livermore Natl Lab, Calif). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 5, 3819-3821(Oct 1981). (CONF-810523—).

From Topical conference on computerized data acquisition in particle and nuclear physics; Oak Ridge, TN, USA (28 May 1981).

A description is given of a microprocessor controlled data acquisition instrument designed at Lawrence Livermore National Laboratory to provide experimenters with a diagnostic tool for measuring the performance of laser imploded fusion targets via neutron activation techniques. This instrument features the ability to count four independent inputs simultaneously while providing a front panel readout of these inputs, plus a time of day clock. A hardcopy printout of the data is also provided by a built-in thermal printer. All running modes and parameters are user selectable via a front panel keypad, and a complete set of internal self-testing diagnostics are available for debug. 3 refs.

41942 **Software design of a general purpose data acquisition and control executive.** Labiak, W.; Minor, E. (Lawrence Livermore Natl Lab, Calif). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 5, 3735-3738(Oct 1981). (CONF-810523—).

From Topical conference on computerized data acquisition in particle and nuclear physics; Oak Ridge, TN, USA (28 May 1981).

The software design of an executive which performs general purpose data acquisition, monitoring, and control is presented. The executive runs on a memory-based mini or micro-computer and communicates with a disk-based computer where data analysis and display are done. The executive design stresses reliability and versatility, and has yielded software which can provide control and monitoring for widely different hardware systems. Applications of this software on two major fusion energy experiments at Lawrence Livermore National Laboratory are described.

41943 **Hydrogen recycling from stainless steel.** Baskes, M.I. (Sandia Natl Lab, Livermore, CA). *Journal of Nuclear Materials;* **99**: No. 2-3, 337-339(Sep 1981).

Recently the PERI computer code has been used to model the recycling in a plasma-wall interaction simulator constructed of 304L stainless steel. This note shows that the spatial distribution of implanted hydrogen ions has an extremely strong effect on the recycling; the experimental data presented are not sufficient to determine the recombination constant and whether recombination or diffusion is the rate limiting process for recycling. 10 refs.

41944 **Shiva laser-fusion facility.** Speck, D.R.; Bliss, E.S.; Glaze, J.A. (Univ. of California, Livermore). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **QE-17**: No. 9, 1599-1619(Sep 1981). Contract W-7405-ENG-48.

The 10 kJ Shiva laser irradiation facility is a major laser experimental facility devoted to inertial confinement fusion (ICF) research. It consists of: (1) a 20-beam Nd:glass laser amplifier system in which each beam has a final clear aperture of 20 cm diameter, (2) optical and alignment systems to focus the 20 beams simultaneously onto microscopic fusion targets, and (3) target diagnostics systems to measure the response of the targets to the irradiating beams. Since its activation in early 1978, Shiva has operated continuously, providing up to 28 terawatts (TW) of 1.064 μm optical power to targets. The evolution of Shiva into a reliable experimental facility required the development of engineering technology based on solid-state laser concepts first introduced in the 1960's and early 1970's.

41945 **Demonstration of direct energy recovery of full-energy ions at 40 keV on a PLT/ISX beam system.** Stirling, W.L.; Barber, G.C.; Dagenhart, W.K. (Oak Ridge National Lab., TN). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1319-1322(Apr 1981). Contract W-7405-ENG-26.

Neutral beam injection systems that employ positive ion sources presently operate at energies of about 40 to 50 keV/nucleon at 60 A [Princeton Large Torus (PLT)] or 100 A [Princeton Divertor Experiment (PDX) or the Oak Ridge National Laboratory (ORNL) Impurities Study Experiment (ISX)] with about 60% conversion efficiency. However, the desire for multisecond beams in the 80-keV/nucleon energy range at ~ 10 MW/module has emphasized the need for technological advances in several areas. At such beam energies, as much as 75% of the initial beam energy is retained in the unneutralized ion components. As a result, two questions immediately come to mind: (1) how can one dispose of this energy; or better still, (2) how can one efficiently recover this energy. We have proposed and demonstrated a unique solution to this problem that not only removes the need for beam dumps but also returns from 50 to 80% of the energy contained in the full energy ion component directly and dynamically to the high voltage supply. In fact, the energy in the residual ion component is not expended. The tests were made on a PLT/ISX-type beam line at 40 keV/nucleon with about 800 kW and 0.1 s.

41946 **Fusion reactor neutronics and shielding.** Abdou, M.A. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **38**: 8-9(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41947 **On the possibility of creating a neutron source on the basis of a micropinch with combined plasma heating.** Gribkov, V.A.; Krokhin, O.N. (Lebedev Phys Inst-USSR, Moscow). *Transactions of the American Nuclear Society;* **38**: 207-208(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41948 **ICF of DT solid micropellets with tampers of Pu, U, or Pb.** Ahnert, C.; Aragones, J.M.; Leira, G.; Martinez-Val, J.M.; Perlado, M.; Velarde, G. (Junta de Energia Nuclear-Spain, Madrid). *Transactions of the American Nuclear Society;* **38**: 208-209(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41949 **Promising regimes for deuterium-based fusion fuel cycles.** Greenspan, E.; Miley, G.H. (Univ of illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **38**: 209-211(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41950 **On the validity of ICF pellet burn perturbation theory.** Coggeshall, S.; Greenspan, E.; Miley, G.H. (Univ of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **38**: 212-213(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41951 **The fusion engineering device: definition and decision.** Clarke, J.F. (US DOE). *Transactions of the American Nuclear Society;* **38**: 6-8(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41952 **02 Oxygen energy storage medium for nuclear pumped laser fusion reactors.** Greenspan, E.; Miley, G.; Zediker, M. (Univ of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **38**: 213-215(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41953 **Preliminary nucleonic considerations for the TFTR lithium blanket module (LBM) design.** Cheung, E.T.; Engholm, B.A. (General Atomic, San Diego, CA 92138). *Transactions of the American Nuclear Society;* **38**: 217-218(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41954 **Themo-hydraulics design considerations for the INTOR breeding blanket.** mer, R.G. C.; Misra, B. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **38**: 219-221(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41955 **A blanket design for deuterium-burning tandem mirror reactors.** Conn, R.W.; Dhir, V.; Ghoniem, N.M.; Grotz, S.P.; Youssef, M.Z. (UCLA, Los Angeles CA 90024). *Transactions of the American Nuclear Society;* **38**: 221-223(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41956 **Neutronic considerations for an optimized fission suppressed hybrid blanket.** Cheng, E.T.; Schultz, K.R. (General Atomic, San Diego, CA 92138). *Transactions of the American Nuclear Society;* **38**: 223-224(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41957 **Enhanced extraction of tritium from LI20 in a helium-purged design.** Norman, J.H.; Schultz, K.R.; Wong, C.P. C. (General Atomic, San Diego, CA 92138). *Transactions of the American Nuclear Society;* **38**: 225-227(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41958 **Impact of tritium recovery system on tritium requirements.** Miller, J.W. (westinghouse-Fusion Power Syst, Pittsburgh, PA 15236). *Transactions of the American Nuclear Society;* **38**: 229-231(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41959 **First wall heat load in the STARFIRE commercial tokamak reactor.** Brooks, J.N.; Gohar, Y. (ANL, Argonne National Laboratory Argonne, IL 60439). *Transactions of the American Nuclear Society;* **38**: 232-233(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41960 **Source-to incident flux relation in a tokamak blanket module.** Imel, G.R. (EG&G Idaho, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **38**: 233-234(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41961 **Thermostructural analysis of the TFTR electrical resistance bellows protective covers.** Fixler, S.Z.; Timlen, W.V. (Grumman Aerospace, Bethpage NY 11714). *Transactions of the American Nuclear Society;* **38**: 234-235(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41962 **Break-even constraints in beam-driven defusion hybrids.** Harns, A.A.; Schoepf, K.F. (McMaster Univ-Canada, Hamilton, Ontario L8S4MI). *Transactions of the American Nuclear Society;* **38**: 235-236(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41963 **Results of parametric neutronic studies for high temperature blankets with breeding.** Fillo, J.A.; Lazareth, O.W.; Makowitz, H.; Powell, J.R. (BNL, Upton, NY 11973). *Transactions of the American Nuclear Society;* **38**: 218-219(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41964 **A subprogram for classification and parameterization of hybrid blankets.** Albrecht, C.S.; Parish, T.A. (Multi-Amp Inst, Dallas, TX 75237). *Transactions of the American Nuclear Society;* **38**: 224-225(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

41965 **Large-scale structural analysis of the Large Coil Test Facility.** Gray, W.H.; Baudry, T.V. (Oak Ridge Natl Lab, Tenn). *AMD [Symposia Series] (American Society of Mechanical Engineers);* **49**: 81-98(1981). (CONF-811101—).

From Winter annual meeting of the ASME Technology and Society Division; Washington, DC, USA (15 Nov 1981).

NASTRAN automatic substructuring was chosen as the finite element method to be used for the Large Coil Test Facility (LCTF) test stand design analysis. This paper describes some of the practical aspects of the test stand structural analysis. The LCTF test stand analysis involves extensive consideration of the usefulness of substructuring, the effectiveness of vendor-supplied and locally developed pre- and postprocessing finite element software, and the efficient utilization of limited computing resources. These considerations plus the analysis problems encountered during the LCTF test stand large-scale analysis are addressed. The LCTF at Oak Ridge National Laboratory (ORNL) will provide an environment for the testing of a compact, toroidal, six-electromagnet array. The six toroidal field (TF) magnets within this array are D-shaped with inner bore dimensions of 2.5*3.5 m in the horizontal and vertical directions, respectively. They are designed-operate at a current of 10-18 Ka at a peak magnetic field of 8 T, while being subjected to pulsed magnetic fields. The test stand provides restraint for in-plane and out-of-plane TF magnet loading conditions while supporting one to six dissimilar coils. 19 refs.

41966 **Fusion power and its prospects.** Kammash, T. (Univ. of Michigan, Ann Arbor). pp 607-685 of Alternative energy sources. Part B. Manassah, J.T. (ed.). New York, NY; Academic Press (1981).

From Symposium on alternative energy sources; Kuwait, Kuwait (1 Feb 1980).

Recent progress in research towards the development of fusion power is reviewed. In the magnetic approach, the impressive advances made in Tokamak research in the past few years have bolstered the confidence that experimental Tokamak devices currently under construction will demonstrate the break-even condition or scientific feasibility of fusion power. Exciting and innovative ideas in mirror magnetic confinement are expected to culminate in high-Q devices which will make open-ended confinement a serious contender for fusion reactors. In the inertial confinement approach, conflicting pellet temperature requirements have placed severe constraints on useful laser intensities and wavelengths for laser-driven fusion. Relativistic electron beam fusion must solve critical focusing and pellet coupling problems, and the newly proposed heavy ion beam fusion, though feasible and attractive in principle, requires very high energy particles for which the accelerator technology may not be available for some time to come.

41967 **(NASA-TM—75844) Plasma chemistry for inorganic materials.** Matsumoto, O. Translated from *Purazuma to Kagaku (Japan);* 49-52(Dec 1980). 12p. NTIS, PC A02/MF A01.

Practical application of plasma chemistry to the development of inorganic materials using both low temperature and warm plasmas are summarized. Topics cover: the surface nitrification and oxidation of metals chemical vapor deposition formation of minute oxide particles the composition of oxides from chloride vapor the composition of carbides and nitrides freezing high temperature phases by plasma arc welding and plasma jet use of plasma in the development of a substitute for petroleum the production of silicon for use in solar cell batteries and insulating the inner surface of nuclear fusion reactor walls.

99 GENERAL AND MISCELLANEOUS

9901 Management

41968 **(SAND—82-0710C) Overview of Sandia National Laboratories present and future.** Winter, C. (Sandia National Labs., Albuquerque, NM (USA)). 9 Mar 1982. Contract AC04-76DP00789. 8p. (CONF-820326—1). NTIS, PC A02/MF A01. Order Number DE82008465.

From Meeting of the National Association of Accountants; Albuquerque, NM, USA (9 Mar 1982).

This evening I would like to tell you a little about Sandia National Laboratories; who we are; what we do; and what our future looks like.

41969 **Affirmative action in the eighties.** Garcia, A.B. (LANL). *Transactions of the American Nuclear Society;* **38**: 79-80(1981). (CONF-810606—).

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 41352, 41529, 41729

41970 **(EUR—7099-EN) Mesh-generating and plotting facilities of the LAMCAL program. User's manual.** Lamain, L.G. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 46p. European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037.

Portions of document are illegible.

The mesh generation and the plotting part of the LAMCAL program are described and the input formats are given. The complete LAMCAL program consists of three parts: mesh generation, elasto-plastic finite element part, and the plotting part. These three parts are connected by means of an overlay structure using peripheral units as interfaces, which allow them to be used together, separate or in combination with other computer programs. As the mesh generator and the plotting part may also be useful for other programs, a separate user manual seems to be justified.

41971 **(IPP—2/253) Infinitesimal rotation. On the converse problem.** Javel, P. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Feb 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82780384.

The problem of finding a vector of constant length verifying dv vector/ds = ω(s)xv vector has been reduced by introducing the referential built on the eigenvectors of the singular operator. Ω identical ω vector x. This procedure represents a natural introduction of complex vectorial spaces in three dimensional geometry.

41972 **(KFK—3128) Progress report on research and development studies of the Abteilung fuer Angewandte Systemanalyse in 1980.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Abt. fuer Angewandte Systemanalyse). Feb 1981. 29p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82780385.

Within the Department of Applied Systems Analysis the consequences and risks, the conditions for realization and acceptancy, as well as the problems of controlling the application of technologies are investigated with regard to technical, ecological, economical and social aspects. Emphasis is laid on energy technologies as well as information and communication technologies. Investigation methods developed for this kind of issue as the technology assessment and the attendant technology research are further developed and applied during the projects carried out by systems analysts.

41973 **(LA—8796-MS) Accurate monotonicity-preserving cubic interpolation.** Hyman, J.M. (Los Alamos National Lab., NM (USA)). Feb 1982. Contract W-7405-ENG-36. 22p. NTIS, PC A02/MF A01. Order Number DE82009964.

A simple and effective algorithm to construct a monotonicity-preserving cubic Hermite interpolant for data with rapid variations is presented. Constraining the derivatives of the interpolant according to geometric considerations makes the interpolant consistent with local monotonicity properties of the data. Numerical examples are given that compare the quality and accuracy of the proposed interpolation method with other standard interpolants.

41974 **(PB—81-146912) A directory of computer software applications, chemistry. Report for June 1978-February 1981.** (National Technical Information Service, Springfield, VA (USA)). Mar 1981. 49p. NTIS PC $35.00/MF$35.00.

Chemistry reports that list computer programs and/or their documentation are cited. These software applications pertain to topics such as chemical engineering, analytical chemistry, and physical chemistry. Although many different applications are covered, there is an emphasis on thermodynamic properties, activation analysis, spectroscopic analysis, orbital and kinetic theory, and pollution control. The directory contains complete bibliographic data for each report as well as a subject and corporate author index. Over 200 reports are cited. The computer software offered by NTIS was created by a variety of Federal agencies to meet their diverse but quite specific objectives. It is provided without installation, support, or maintenance services and sometimes requires customer modifications to run effectively in customer environments.

41975 **Versatile data acquisition system and the ISOL facility TRISTAN.** Gill, R.L.; Stelts, M.L.; Chrien, R.E.; Manzella, V.; Liou, H. (Brookhaven National Lab., Upton, NY (USA)); Shostak, S. (Rochester Univ., NY (USA)). *Nuclear Instruments and Methods in Physics Research;* **186**: No. 1/2, 243-255(1 Jul 1981).

From 10. international conference on electromagnetic isotope separates and techniques related to their applications; Zinal, Switzerland (1 - 6 Sep 1980).

We have constructed a versatile, modular data acquisition system to service experiments on TRISTAN and other nuclear research facilities at the HFBR using CAMAC interfacing. Standard, commercially-available electronic instruments and computer programs, such as FORTRAN and system routines, are used throughout. Simple interfaces have been built to adapt non-CAMAC equipment to CAMAC input registers. Up to eight different experiments can be multiplexed on the branch highway by a fast microprogrammed branch driver with a 4096 word memory. The branch driver delivers pre-processed data to a bus which links devices such as a central processor, 1 megaword core memory, tape drives, discs, display processor and terminal. The following features are offered: two 8192 channel pulse height analyzers, a 3-parameter coincidence unit, 4 multiscalers, a timed sequence of delayed γ-ray spectra (33 spectra of 4096 channels each), a 2-parameter (pulse height versus time-of-flight) analyzer, 16 scalers and 24 experimental interlocks. Up to 100 different spectra are available to users for display during an experiment.

9903 Information Handling

REFER ALSO TO CITATION(S) 40218, 41972

9904 Law

REFER ALSO TO CITATION(S) 40240, 40898

9905 Civilian Defense

41976 **(AD-A—098172/0) Analysis of effectiveness of civil defense program elements. Final report.** Devaney, J.F.; Strope, W.E. (Center for Planning and Research, Inc., Palo Alto, CA (USA)). Jun 1980. 123p. NTIS PC A06/MF A01.

A methodology is documented that allows the analysis of a civil defense program for which estimates of overall performance have been made using the Population Defense (POPDEF) and Program Analysis (PAM) models so as to ascertain the relative contributions of the elements of the program to its effectiveness. The method is applied to a candidate program and estimates of the program in terms of added survival, total and uninjured. The relative effectiveness of program elements, individually and in selected combinations, is given in terms of cost per survivor added.

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In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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Title, (supplementary information), citation number, (report number)

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

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13/ 80	*See* AD-A-098257/9			7:40392
CNEA-				
447	NTIS (US Sales Only), PC A02/MF A01	DE82701035	MN -4	7:41510
450	NTIS (US Sales Only), PC A02/MF A01	DE82701032	MN -4	7:41171
455	NTIS (US Sales Only), PC A02/MF A01	DE82701036	MN -4	7:41217
458	NTIS (US Sales Only), PC A02/MF A01	DE82701037	MN -4	7:41218
460	NTIS (US Sales Only), PC A02/MF A01	DE82701038	MN -4	7:41219
461	NTIS (US Sales Only), PC A02/MF A01	DE82701039	MN -4	7:41220
465	NTIS (US Sales Only), PC A02/MF A01	DE82701033	MN -4	7:41192
CONF-790117-	(3. US/USSR symposium on fusion - fission hybrids, Princeton, NJ, USA, 22-26 Jan 1979)			
4	*See* PNL-SA-7700	DE82008592	MN -20	7:41938
CONF-7904187-	(Doble client conference, Boston, MA, USA, 2-6 Apr 1979)			
1	*See* PNL-SA-7529	DE82008594	MN -97e	7:40720
CONF-790690-	(4. international conference on laser spectroscopy, Rottach-Egern, Tegernsee, F.R. Germany, 11-15 Jun 1979)			
	See PB-81-137895			7:41267
CONF-790803-	(14. intersociety energy conversion conference, Boston, MA, USA, 5-10 Aug 1979)			
66	*See* PNL-SA-7648	DE82008593	MN -94e	7:40824
CONF-7910128-	(Nordic symposium on earth heat pump systems, Goteborg, Sweden, 15-16 Oct 1979)			
	Goeteborg, Sweden; Chalmers University of Technolog. Earth Heat Pump Group (1979).			7:40629
CONF-800295-	(Symposium on alternative energy sources, Kuwait, Kuwait, 1 Feb 1980)			
Pt.B	Academic Press, Inc., 111 Fifth Ave., New York, NY 10003			7:40726
CONF-800655-	(21. annual meeting of the Institute of Nuclear Materials Management, Palm Beach, FL, USA, 30 Jun-2 Jul 1980)			
37	*See* PNL-SA-8443	DE82008562	MN -16	7:40326
CONF-8006108-	(11. international symposium on multiparticle dynamics, Bruges, Belgium, 22-27 Jun 1980)			
8	*See* MPI-PAE/EXP.EL.-89	DE82780454	MN -34D	7:41829
CONF-8009132-	(14. European conference on laser interaction with matter, Palaiseau, France, 15-19 Sep 1980)			
8	*See* PLF-41		ND -20	7:41913
CONF-8010260-	(Annual Clay Minerals Society conference, Waco, TX, USA, 5-7 Oct 1980)			
1	*See* LBL-12348	DE82008925	MN -66a	7:40673
CONF-8011147-	(ISMA conference, Vienna, Australia, 11-13 Nov 1980)			
1	*See* TVA/PUB-82/7	DE82901247	MN -4	7:41022
CONF-810376-	(16. rencontre de moriond: nonperturbative QCD: theory and experiment, Les Arcs, France, 15-27 Mar 1981)			
9	*See* CEA-CONF-5737	DE82700955	MN -34D	7:41833

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CONF-8103119-	(Symposium on organ and species specificity in chemical carcinogenesis, Raleigh, NC, USA, 2-4 Mar 1981)			
1	NTIS, PC A02/MF A01	DE82008843	MN -48	7:41635
CONF-810523-	(Topical conference on computerized data acquisition in particle and nuclear physics, Oak Ridge, TN, USA, 28-30 May 1981)			
	IEEE Trans. Nucl. Sci., NS-28: No. 5, 3819-3821(Oct 1981)			7:41941
	IEEE Trans. Nucl. Sci., NS-28: No. 5, 3735-3738(Oct 1981)			7:41942
CONF-810606-	(American Nuclear Society's annual meeting, Miami Beach, FL, USA, 7-12 Jun 1981)			
	Trans. Am. Nucl. Soc., 38: 129-130(1981)			7:41129
	Trans. Am. Nucl. Soc., 38: 179-181(1981)			7:41316
	Trans. Am. Nucl. Soc., 38: 107-108(1981)			7:41418
	Trans. Am. Nucl. Soc., 38: 97-98(1981)			7:41419
	Trans. Am. Nucl. Soc., 38: 3-4(1981)			7:41429
	Trans. Am. Nucl. Soc., 38: 108-110(1981)			7:41430
	Trans. Am. Nucl. Soc., 38: 111-112(1981)			7:41431
	Trans. Am. Nucl. Soc., 38: 110-111(1981)			7:41448
	Trans. Am. Nucl. Soc., 38: 178-179(1981)			7:41449
	Trans. Am. Nucl. Soc., 38: 81(1981)			7:41613
	Trans. Am. Nucl. Soc., 38: 63-64(1981)			7:41614
	Trans. Am. Nucl. Soc., 38: 83-84(1981)			7:41615
	Trans. Am. Nucl. Soc., 38: 91-92(1981)			7:41616
	Trans. Am. Nucl. Soc., 38: 95-96(1981)			7:41617
	Trans. Am. Nucl. Soc., 38: 59-60(1981)			7:41618
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	Trans. Am. Nucl. Soc., 38: 211-212(1981)			7:41919
	Trans. Am. Nucl. Soc., 38: 215-216(1981)			7:41920
	Trans. Am. Nucl. Soc., 38: 8-9(1981)			7:41946
	Trans. Am. Nucl. Soc., 38: 207-208(1981)			7:41947
	Trans. Am. Nucl. Soc., 38: 208-209(1981)			7:41948
	Trans. Am. Nucl. Soc., 38: 209-211(1981)			7:41949
	Trans. Am. Nucl. Soc., 38: 212-213(1981)			7:41950
	Trans. Am. Nucl. Soc., 38: 6-8(1981)			7:41951
	Trans. Am. Nucl. Soc., 38: 213-215(1981)			7:41952
	Trans. Am. Nucl. Soc., 38: 217-218(1981)			7:41953
	Trans. Am. Nucl. Soc., 38: 219-221(1981)			7:41954
	Trans. Am. Nucl. Soc., 38: 221-223(1981)			7:41955
	Trans. Am. Nucl. Soc., 38: 223-224(1981)			7:41956
	Trans. Am. Nucl. Soc., 38: 225-227(1981)			7:41957
	Trans. Am. Nucl. Soc., 38: 229-231(1981)			7:41958
	Trans. Am. Nucl. Soc., 38: 232-233(1981)			7:41959
	Trans. Am. Nucl. Soc., 38: 233-234(1981)			7:41960
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	Trans. Am. Nucl. Soc., 38: 235-236(1981)			7:41962
	Trans. Am. Nucl. Soc., 38: 218-219(1981)			7:41963
	Trans. Am. Nucl. Soc., 38: 224-225(1981)			7:41964
	Trans. Am. Nucl. Soc., 38: 79-80(1981)			7:41969
105	*See* HEDL-SA-2313	DE82008422	MN -78	7:40753
CONF-810647-	(Conference on X- and gamma-ray sources and applications, Ann Arbor, MI, USA, 10-12 Jun 1981)			
Absts.	NTIS, PC A03/MF A01	DE82011862	MN -48	7:40335
CONF-810847-	(28. international union of pure and applied chemistry symposium, Vancouver, British Columiba, Canada, Aug 1981)			
3	*See* LBL-12534	DE82011034	MN -4	7:41167
CONF-8110127-	(IAEA meeting on gas-cooled reactors, Minsk, USSR, 12-16 Oct 1981)			
2	*See* GEFR-SP-258	DE82007538	MN -77	7:40752
CONF-8110141-	(Conference on large body impacts and terrestrial evolution, Snowbird, UT, USA, 18-22 Oct 1981)			
2	*See* LBL-13904	DE82011145	MN -11	7:41725
CONF-8110167-	(International Society for Tropical Ecology jubilee symposium, Bhopal, India, 1 Oct 1981)			
1	*See* DOE/EV/10725-2	DE82011827	MN -11	7:41354
CONF-8110190-	(4. technical contractors' conference on peat, Bethesda, MD, USA, 22-23 Oct 1981)			
1	Inst. Gas Technology, 3424 South State Street, Chicago, IL 60616		MN -90	7:40101
CONF-8110201-	(International peat symposium, Bemidji, MN, USA, 21-23 Oct 1981)			
1	Inst. Gas Technology, 3424 South State Street, Chicago, IL 60616		MN -61a	7:40102
CONF-811101-	(Winter annual meeting of the ASME Technology and Society Division, Washington, DC, USA, 15-20 Nov 1981)			
	AMD [Symp. Ser.] (Am. Soc. Mech. Eng.), 49: 81-98(1981)			7:41965
CONF-811103-	(ANS winter meeting, San Francisco, CA, USA, 29 Nov-4 Dec 1981)			
120	*See* DP-MS-81-57	DE82008186	MN -70	7:40279
CONF-811145-	(International conference on neutron irradiation effects, Argonne, IL, USA, 9-12 Nov 1981)			
8	*See* HEDL-SA-2514	DE82008436	MN -20	7:41933

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CONF-811185-	(Japan/US workshop on nonequilibrium statistical physics, Kyoto, Japan, 9-13 Nov 1981)			
1	*See* LBL-13621	DE82008429	MN -20	7:41912
CONF-811225-	(Conference on dynamical systems in hydrodynamics, La Jolla, CA, USA, 7-9 Dec 1981)			
3	*See* LBL-13959	DE82011778	MN -34	7:41817
CONF-820106-	(20. aerospace science conference, Orlando, FL, USA, 11-14 Jan 1982)			
6	NTIS, PC A02/MF A01	DE82008833	MN -63	7:40456
CONF-820107-	(SPIE optical coatings for energy efficiency and solar applications conference, Los Angeles, CA, USA, 25-29 Jan 1982)			
9	*See* PNL-SA-10169	DE82008566	MN -62	7:40637
CONF-820127-	(6. annual conference on energy from biomass wastes, Lake Buena Vista, FL, USA, 25-29 Jan 1982)			
6	Inst. of Gas Tech., 3424 South State Street, Chicago, IL 60616		MN -61a	7:40395
8	Inst. of Gas Tech., 3424 South State Street, Chicago, IL 60616		MN -61a	7:40396
CONF-820139-	(Workshop on the galactic center, Pasadena, CA, USA, 7-8 Jan 1982)			
	American Inst. of Physics, 335 E. 45th St., New York, NY 10017			7:41781
CONF-820140-	(1. annual conference on management, analysis and display of geoscience data, Golden, CO, USA, 27-29 Jan 1982)			
1	NTIS, PC A03/MF A01	DE82008543	MN -35	7:41729
CONF-820141-	(Public Works Canada symposium, Ottawa, Canada, 25-27 Jan 1982)			
1	*See* LBL-13931	DE82008598	MN -95d	7:40946
CONF-820202-	(AICHE 1982 national winter meeting, Orlando, FL, USA, 28 Feb-3 Mar 1982)			
12	*See* EGG-M-00782	DE82008612	MN -4	7:41202
13	*See* EGG-M-00682	DE82008606	MN -38	7:40762
CONF-820205-	(111. AIME annual meeting, Dallas, TX, USA, 1 Feb 1982)			
3	*See* EGG-M-03182	DE82008607	MN -90c	7:41106
CONF-820217-	(9. energy technology conference, Washington, DC, USA, 16-18 Feb 1982)			
2	*See* PNL-SA-10230	DE82008581	MN -95d	7:40965
CONF-820230-	(Workshop on optical and laser remote sensing, Monterey, CA, USA, 9-11 Feb 1982)			
2	*See* LBL-14051	DE82008870	MN -34	7:41181
CONF-820232-	(Canadian biomass liquefaction research group meeting, Saskatoon, Saskatchewan, Canada, 16-17 Feb 1982)			
1	*See* LBL-14017	DE82008426	MN -61a	7:40434
CONF-820233-	(National Research Council workshop on stable isotopes and derived radioisotopes, Washington, DC, USA, 3-4 Feb 1982)			
1	NTIS, PC A02/MF A01	DE82008377	MN -22	7:40330
CONF-820234-	(WATTec energy conference and exhibition, Knoxville, TN, USA, 24-26 Feb 1982)			
1	NTIS, PC A02/MF A01	DE82008807	MN -86	7:40271
CONF-820303-	(Waste management conference, Tucson, AZ, USA, 8-11 Mar 1982)			
13	*See* SAND-82-0517C	DE82011470	MN -70	7:40276
22	*See* DP-MS-81-92	DE82008917	MN -70	7:40280
23	NTIS, PC A02/MF A01	DE82008830	MN -70	7:40277
CONF-820304-	(183. American Chemical Society annual meeting, Las Vegas, NV, USA, 27 Mar-2 Apr 1982)			
13	*See* PNL-SA-10222	DE82008584	MN -4	7:41208
17	Inst. of Gas Tech., 3424 South State St., Chicago, IL 60616		MN -90c	7:40100
CONF-820306-	(6. symposium on temperature, Washington, DC, USA, 14-18 Mar 1982)			
4	NTIS, PC A03/MF A01	DE82008844	MN -80	7:40737
CONF-820314-	(National Association of Corrosion Engineers conference, Houston, TX, USA, 22-26 Mar 1982)			
6	NTIS, PC A02/MF A01	DE82008828	MN -20c	7:41103
CONF-820321-	(4. ASTM-EURATOM symposium on reactor dosimetry, Gaithersburg, MD, USA, 22-26 Mar 1982)			
2	*See* SAND-81-0359C	DE82008190	MN -80	7:40759
CONF-820325-	(International symposium on the electronic structure and properties of hydrogen in metals, Richmond, VA, USA, 4-6 Mar 1982)			
1	*See* SAND-82-0168C	DE82008467	MN -25	7:41151
2	*See* MLM-2905(OP)	DE82008461	MN -25	7:41148
3	*See* MLM-2904(OP)	DE82008462	MN -25	7:41147
4	*See* MLM-2906(OP)	DE82008460	MN -25	7:41149
CONF-820326-	(Meeting of the National Association of Accountants, Albuquerque, NM, USA, 9 Mar 1982)			
1	*See* SAND-82-0710C	DE82008465	MN -13	7:41968
CONF-820327-	(International training course on implementation of state systems of accounting for a control of nuclear materials, Santa Fe, NM, USA, 15-30 Mar 1982)			
1	*See* SAND-82-0548C	DE82008215	MN -16	7:40327
CONF-820331-	(3. conference on gaseous dielectrics, Knoxville, TN, USA, 7-11 Mar 1982)			
1	NTIS, PC A02/MF A01	DE82008840	MN -97	7:40717
7	NTIS, PC A02/MF A01	DE82008805	MN -97	7:41634

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CONF-820332-	(Spring ASNT conference, Boston, MA, USA, 1 Mar 1982)			
1	*See* PNL-SA-10025	DE82008579	MN -38	7:41275
CONF-820335-	(International symposium on applications and technology of ionizing radiations, Malaz, Riyadh, Saudi Arabia, 12-17 Mar 1982)			
1	NTIS, PC A02/MF A01	DE82008836	MN -4	7:41813
CONF-820339-	(1. international symposium on halide and other non-oxide glasses, Cambridge, UK, 1 Mar 1982)			
1	*See* UCRL-87232	DE82008997	MN -91	7:41270
CONF-820340-	(Symposium on compression testing of homogenous materials and composites, Williamsburg, VA, USA, 10-12 Mar 1982)			
1	*See* SAND-81-1202C	DE82008194	MN -25	7:41155
CONF-820418-	(UCC-ND and GAT environmental protection seminar, Gatlinburg, TN, USA, 5-7 Apr 1982)			
4	*See* GAT-T-3116	DE82011810	MN -2	7:41413
6	*See* GAT-S-26	DE82011714	MN -69	7:40282
7	*See* GAT-S-24	DE82011811	MN -25	7:41282
8	*See* K/TL/AT-98	DE82008326	MN -11	7:41441
CSIRO-				
33	Commonwealth Scientific and Industrial Research Organization, PO Box 54, Mount Waverley, Victoria 3149, Australia			7:40166
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2700Z-001-81	*See* AD-A-097832/0			7:41255
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8	NTIS, PC A11/MF A01	DE82009072	STD -92a	7:40210
DOE/CS/20239-				
1	NTIS, PC A05/MF A01	DE82009288	MN -95e	7:41042
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T1	NTIS, PC A02/MF A01	DE82008820	MN -59	7:40630
DOE/CS/40071-				
22	NTIS, PC A02/MF A01	DE82009388	MN -95f	7:40990
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T1	NTIS, PC A07/MF A01	DE82010892	STD -95f	7:40991
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T1	NTIS, PC A03/MF A01	DE82011421	MN -96	7:40992
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1123	NTIS, PC A10/MF A01	DE82009044	MN -91	7:40252
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T1	NTIS, PC A02/MF A01	DE82011600	MN -21	7:40329
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0046	NTIS, PC A02/MF A01	DE82009173	MN -92a	7:40247
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5	NTIS, PC A02/MF A01	DE82011255	MN -34D	7:41834
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1	NTIS, PC A02/MF A01	DE82008817	MN -4	7:41871
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4	NTIS, PC A03/MF A01	DE82011863	MN -4	7:40364
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3	NTIS, PC A02/MF A01	DE82008459	MN -25	7:41104
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28	NTIS, PC A02/MF A01	DE82011591	MN -34	7:41894
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2	NTIS, PC A02/MF A01	DE82011594	MN -4	7:41201
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1	NTIS, PC A02/MF A01	DE82008782	MN -34	7:41814
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1	NTIS, PC A03/MF A01	DE82008293	MN -90	7:40132
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T1	NTIS, PC A02/MF A01	DE82008787	MN -38	7:41159
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1	NTIS, PC A02/MF A01	DE82008815	MN -4	7:41895
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1	NTIS, PC A02/MF A01	DE82008909	MN -34	7:41236
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T2	NTIS, PC A02/MF A01	DE82008435	MN -20a	7:41926
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321	NTIS, PC A02/MF A01	DE82008493	MN -34D	7:41844
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50	NTIS, PC A03/MF A01	DE82008447	STD -90d	7:40103
54	NTIS, PC A04/MF A01	DE82009084	STD -90d	7:40104
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T1	NTIS, PC A09/MF A01	DE82008389	MN -92a	7:40211
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T8	Mining Informational Services, McGraw-Hill, Inc. 1221 Avenue of the Americas, New York, NY 10020			7:40167
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T8	NTIS, PC A02/MF A01	DE82007811	MN -90	7:40158
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78/ 1	NTIS, PC A10/MF A01	DE82009124	STD -60	7:40679
81/ 2	NTIS, PC A04/MF A01	DE82009058	STD -60	7:40680

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DOE/ET/20272-152	NTIS, PC A03/MF A01	DE82009178	STD -63	7:40457
DOE/ET/27167-T2	NTIS, PC A05/MF A01	DE82008335	MN -66i	7:40674
DOE/ET/29044-1	NTIS, PC A07/MF A01	DE82008973	STD -97a	7:41154
DOE/ET/29239-1	NTIS, PC A05/MF A01	DE82009177	STD -97a	7:40718
DOE/ET/29359-1	NTIS, PC A05/MF A01	DE82008334	STD -63b	7:40458
DOE/ET/33062-T5	NTIS, PC A03/MF A01	DE82007171	MN -23	7:40919
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DOE/EV/01105-279	NTIS, PC A02/MF A01	DE82009362	MN -41	7:41884
281	NTIS, PC A02/MF A01	DE82009364	MN -41	7:41881
282	NTIS, PC A02/MF A01	DE82009365	MN -41	7:41563
283	NTIS, PC A02/MF A01	DE82009367	MN -41	7:41564
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285	NTIS, PC A02/MF A01	DE82009369	MN -41	7:41886
286	NTIS, PC A02/MF A01	DE82009370	MN -41	7:41882
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2	NTIS, PC A02/MF A01	DE82011827	MN -11	7:41354
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DOE/FE/05147-T3	NTIS, PC A05/MF A01	DE82011040	STD -90c	7:40171
DOE/JPL/954355-81-20	NTIS, PC A03/MF A01	DE82008676	STD -63b	7:40397
DOE/MC/14400-05	NTIS, PC A04/MF A01	DE82009126	MN -90c	7:40105
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DOE/MC/14593-T2	NTIS, PC A03/MF A01	DE82008687	MN -90c	7:40107
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DOE/PC/30075-8	NTIS, PC A03/MF A01	DE82008180	MN -90d	7:40112
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DOE/PC/30294-5	NTIS, PC A02/MF A01	DE82008183	MN -90e	7:40183
DOE/PC/40090-T1	NTIS, PC A03/MF A01	DE82011900	MN -90d	7:40113
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DOE/PC/40778-T2	NTIS, PC A02/MF A01	DE82008927	MN -90d	7:40114
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DOE/PC/40810-1	NTIS, PC A02/MF A01	DE82008882	MN -90d	7:40135
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DOE/SF/11485-1	NTIS, PC A05/MF A01	DE82011939	STD -58	7:40600
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11600(Vol.4)	NTIS, PC A07/MF A01	DE82008934	MN -20	7:41931
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82-13	General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -13	7:40856
82-20	General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -98	7:40878
82-34	General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -92	7:40219
82-36	General Accounting Office, Washington, DC 20548		MN -41	7:40864
82-39	General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -98G	7:40879
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82-64	General Accounting Office, Washington, DC 20548		MN -70	7:40281
ENPU-80-3	Environmental Protecton Unit, Building 151, Harwell Laboratory, Oxfordshire, OX11 ORA, England		ND -70	7:41730
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2217	NTIS, PC A08/MF A01	DE82901847	MN -90i	7:41355
2231	NTIS, PC A14/MF A01	DE82902073	MN -94e	7:40825
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EUR-				
6603-FR	European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037		ND -94d	7:40339
6770-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -98	7:40881
6779/ 2-EN	European Community information Service, 2100 M Street, NW, Suite 707, Washington, DC 20037		ND -13	7:40849
6779/ 111-EN	European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037		ND -13	7:40850
6781-EN	European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037		ND -98	7:40851
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6854-DE	European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037		ND -41	7:40362
6916-EN	European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037		ND -95e	7:40993
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7033-DE	European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037		ND -63	7:40405
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7062-EN	European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037		ND -66	7:40672
7065-DE	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -94c	7:40827
7068-FR	European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037		ND -94	7:40995
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7099-EN	European Community Information Service, 2100 M Street N.W., Suite 707, Washington, DC 20037		ND -38	7:41970
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7306-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -59c	7:40388
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7529-DE	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -93	7:40703
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7565-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -61	7:41003
7566-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -61	7:41207
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7578-DE	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -66a	7:40668
7579-FR	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -66	7:40675
7589-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -61b	7:40345
7591-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -48	7:41470
7592-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -61	7:40425
7594-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -61a	7:40426
7607-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -61c	7:40346
7610-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -94	7:40347
7642-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -95e	7:41005
7661-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -90	7:40348

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7686-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -61a	7:40432
7697-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -59c	7:40647
73538-EN	Commission of the European Communities, Directorate-General for Information Market and Innovation, Jean Monnet Building, Luxembourg		ND -61a	7:40433
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10067	*See* AD-A-102874/5			7:41289
GAT-S-				
24	NTIS, PC A02/MF A01	DE82011811	MN -25	7:41282
26	NTIS, PC A02/MF A01	DE82011714	MN -69	7:40282
GAT-T-				
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GEFR-SP-				
258	NTIS, PC A02/MF A01	DE82007538	MN -77	7:40752
GKSS-				
79/ E/ 53	Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt mbH, 2054 Geesthacht, Germany		ND -48	7:41557
80/ E/ 44	NTIS (US Sales Only), PC A02/MF A01	DE82780379	MN -11	7:41452
81/ E/ 34	GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)		ND -11	7:41357
GRS-A-				
493	Gesellschaft fuer Reaktorsicherheit, (GRS) mbH-Glockengasse 2, Koeln, Germany		ND -78	7:40767
GSF-B-				
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82-17	General Accounting Office, PO Box 6015, Gaithersburg, MD 20760		MN -58	7:40912
IFVE-OEIPK-				
80-129	NTIS (US Sales Only), PC A02/MF A01	DE82700789	MN -34D	7:41821
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81-33	NTIS (US Sales Only), PC A02/MF A01	DE82700956	MN -34D	7:41822
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80-144	NTIS (US Sales Only), PC A02/MF A01	DE82700957	MN -34D	7:41835
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81-85	NTIS (US Sales Only), PC A02/MF A01	DE82700959	MN -34D	7:41836
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6477	NTIS (US Sales Only), PC A04/MF A01	DE82700808	MN -4	7:41179
6734	NTIS (US Sales Only), PC A10/MF A01	DE82780062	MN -2	7:40743
6759	NTIS (US Sales Only), PC A04/MF A01	DE82780400	MN -2	7:40875
6783	NTIS (US Sales Only), PC A04/MF A01	DE82780392	MN -70	7:40283
6784	NTIS (US Sales Only), PC A05/MF A01	DE82780393	MN -70	7:40284
6785	NTIS (US Sales Only), PC A11/MF A01	DE82780394	MN -70	7:40285
6786	NTIS (US Sales Only), PC A06/MF A01	DE82780395	MN -70	7:40286
6787	NTIS (US Sales Only), PC A06/MF A01	DE82780396	MN -70	7:40287
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6789	NTIS (US Sales Only), PC A07/MF A01	DE82780398	MN -70	7:40289
6799	NTIS (US Sales Only), PC A08/MF A01	DE82780401	MN -2	7:41567
6800	NTIS (US Sales Only), PC A04/MF A01	DE82780402	MN -2	7:41848
6805	NTIS (US Sales Only), PC A06/MF A01	DE82780323	MN -34C	7:41855
6811	NTIS (US Sales Only), PC A05/MF A01	DE82780403	MN -2	7:40922
6815	NTIS (US Sales Only), PC A05/MF A01	DE82780399	MN -2	7:40318

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2/ 253	NTIS (US Sales Only), PC A02/MF A01	DE82780384	MN -32	7:41971
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239	Pod Vodarenskou VEZI 4, 18069 Prague 8, Czechoslovakia		ND -20f	7:41909
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4787	NTIS, PC A50/MF A01	DE82007854	MN -70A	7:40765
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87(1980)	NTIS (US Sales Only), PC A04/MF A01	DE82700960	MN -34D	7:41838
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JAERI-M-				
9151	NTIS (US Sales Only), PC A03/MF A01	DE82700738	MN -32	7:40754
9226	NTIS (US Sales Only), PC A03/MF A01	DE82700739	MN -32	7:41935
9251	NTIS (US Sales Only), PC A04/MF A01	DE82700740	MN -32	7:40729
9261	NTIS (US Sales Only), PC A04/MF A01	DE82700741	MN -32	7:40763
9264	NTIS (US Sales Only), PC A03/MF A01	DE82700742	MN -32	7:40735
9278	NTIS (US Sales Only), PC A02/MF A01	DE82700743	MN -32	7:41910
9285	NTIS (US Sales Only), PC A06/MF A01	DE82700744	MN -32	7:40768
9286	NTIS (US Sales Only), PC A07/MF A01	DE82700745	MN -32	7:40769
9856	Japan Energy Research Institute, Information Section, Division of Technical Information, Tokai-mura, Naka-gun, Ibaraki-ken, Japan		ND -4	7:41214
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1-80-778	NTIS (US Sales Only), PC A02/MF A01	DE82701013	MN -34C	7:41868
1-80-858	NTIS (US Sales Only), PC A02/MF A01	DE82701014	MN -34C	7:41823
1-80-859	NTIS (US Sales Only), PC A02/MF A01	DE82701015	MN -34C	7:41824
1-81-329	NTIS (US Sales Only), PC A02/MF A01	DE82701016	MN -34C	7:41857
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E-15-80-444	NTIS (US Sales Only), PC A02/MF A01	DE82700798	MN -34C	7:41858
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3-81-480	NTIS (US Sales Only), PC A02/MF A01	DE82701018	MN -34C	7:41862
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1-80-780	NTIS (US Sales Only), PC A02/MF A01	DE82701025	MN -34C	7:41850
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12-80-379	NTIS (US Sales Only), PC A02/MF A01	DE82700809	MN -4	7:41180
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98	NTIS, PC A03/MF A01	DE82008326	MN -11	7:41441
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3048	Kernforschungszentrum Karlsruhe GmbH, Germany		ND -78	7:40770
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3128	NTIS (US Sales Only), PC A03/MF A01	DE82780385	MN -2	7:41972
3137	Kernforschungszentrum Karlsruhe GmbH, Germany		ND -34	7:41242
3155	Institut fuer Kern- und Teilchenphysik, Kernforschungszentrum Karlsruhe, GmbH, Karlsruhe, Germany		ND -34C	7:40336
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80-14	NTIS (US Sales Only), PC A02/MF A01	DE82701031	MN -34C	7:41873
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8796-MS	NTIS, PC A02/MF A01	DE82009964	STD -32	7:41973
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8956-PR	NTIS, PC A05/MF A01	DE82009547	STD -91	7:40257
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9199-MS	NTIS, PC A03/MF A01	DE82009082	STD -70	7:41224
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82-443	NTIS, PC A02/MF A01	DE82008154	MN -11	7:40868
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82-61-0003	*See* DOE/DP/00053-1123	DE82009044	MN -91	7:40252
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2903650	United States Dept. of the Interior, Bureau of Land Management, New York Outer Continental Shelf Office, 26 Federal Plaza, Suite 32-120, New York, NY 10278		MN -92a	7:40223
2903788	National Conference of State Legislatures Energy Program, 1125-17th Street, Suite 1500, Denver, CO 80202, $3.00		MN -95	7:40951
2903870	Institut fuer Kerntechnik, MarchstraBe 18, 1000 Berlin 10, Germany		ND -78	7:40771
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2904121	Wallace B. Howe, Director and State Geologist, Geology and Land Survey, Dept. of Natural Resources, Buehler Park, P.O. Box 250, Rolla, MO 65401, $4.00		MN -11	7:41726
2904124	Missouri Dept. of Natural Resources, Division of Geology and Land Survey, P.O. Box 250, Rolla, MO 65401, $3.00 + postage and handling		MN -91	7:40256
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8236	*See* NUREG/CR-2586	DE82009406	MN -80	7:40756
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